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ABSTRACT

This book is an attempt to document the impact of environmental concerns on higher education in recent years as expressed in university courses, curricula, programs, and centers that have modified conventional disciplines or led to new multidisciplinary arrangements, schools, and colleges. The forty-five case studies presented describe environmental studies programs of both large and small colleges and universities, and encompass undergraduate general studies, varied graduate and professional programs, basic and applied research, and extension and continuing education. (MB)

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ENVIRONMENTAL EDUCATION IN ACTION—II: CASE STUDIES OF ENVIRONMENTAL STUDIES PROGRAMS IN COLLEGES AND UNIVERSITIES TODAY

Selected and Edited by

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and

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Columbus, Ohio 43212

February, 1978

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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for this series are invited.

John F. Disinger
Associate Director
Environmental Education

Sponsored by the Educational Resources Information Center of the National Institute of Education and The Ohio State University.

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FOREWORD

Many segments of our society have become involved in environmental considerations during the 1970's; they are welcome additions to those who have demonstrated such concerns over longer periods of time. Certainly one group to which we must look for input, and leadership, includes our institutions of higher education. As custodians and purveyors of our culture, generators of new knowledge, and advisers in the application of all knowledge, they occupy key positions in our societal response to the shaping of the future, particularly including intelligent interaction with the environment.

To date, no comprehensive study has emerged to detail the current status of environmental studies in our colleges and universities. We know that much as been accomplished; we are even more certain that a great deal remains to be done—by all of us, including our post-secondary institutions. Many are impatient with the lack of response to environmental concerns evidenced by those institutions, and indeed by all of us.

The editors of this compendium of Case Studies of Environmental Studies Programs in Colleges and Universities Today take issue with the statement that it is easier to move a cemetery than to move a university faculty and its curriculum, though a reading of the papers presented here indicates that initiating and sustaining such movement is not easy, much less automatic. However, the studies leave little doubt that significant accomplishments have been made, and hold out the promise that additional progress is imminent.

A striking feature of the papers included here is variety, in terms of size and type of institution involved in environmental studies, geography, and areas of academic concern. We see that many facets of the university are demonstrating positive response to environmental considerations, ranging alphabetically from Alabama to Wyoming, from agriculture to zoology, touching many points between. Small institutions are represented, as are the largest multiversities. We share with the editors the belief that these programs are representative, and do not provide an encyclopedic listing. If they are also exemplary, so be it--they provide excellent examples of what has been done, how it has been done, why it has been done, and the problems encountered in doing it.

The candor of the authors of individual papers is refreshing, and heartening. It may be that other institutions will profit from their experiences, including not only their false starts and other problems, but also their accomplishments and their indications of where they hope to go in the future. Certainly these institutions, and authors, have learned from their own histories; if other institutions and faculties can derive the same lessons from them, they should not be doomed to repeat their errors. Moreover, they may find much that will provide templates in terms of goals and objectives, programming, and strategies.

Walter E. Jeske, Chairman
Subcommittee on Environmental Education
Federal Interagency Committee on Education

February, 1978

PREFACE

The studies in this volume were solicited by the editors, using the guidelines specified in the Prologue. An attempt was made to secure studies from a broad spectrum of emphases. Most of the studies were written specifically for this compendium, on request. The editors thank the authors of these studies, and their institutions, for their willingness to prepare them, and particularly for their response to the admonition for straightforward reporting and analysis. The case studies are arranged alphabetically by last name of senior author.

The editors previously collaborated on Environmental Education in Action--I: Case Studies of Selected Public School and Public Action Programs, published by ERIC/SMEAC in January 1977, and have begun work on a third volume in the series, Environmental Education in Action--III: Case Studies of Selected Public Action Programs, also to be published by ERIC/SMEAC.

C.A.S.
J.F.D.

February, 1978

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ENVIRONMENTAL EDUCATION IN ACTION—II: CASE STUDIES OF ENVIRONMENTAL STUDIES PROGRAMS IN COLLEGES AND UNIVERSITIES TODAY

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PROLOGUE

This book is an attempt to document the impact of environmental concerns on higher education in recent years as expressed in university courses, curricula, programs, and centers that have modified conventional disciplines or led to new multidisciplinary arrangements, schools, and colleges.

Ours is not a quantitative survey of environmental departures in university enterprise; the case studies represented here were not selected at random. But neither were they deliberately chosen to give the compendium a particular slant.

We used as our initial point of entre to universities the summer session deans holding membership in the Association of University Summer Sessions—50 major institutions of varying size, location, structure, and mission. Summer deans tend to be knowledgeable about broad developments on their campuses. We asked each dean to give us:

> *The names and addresses of the principal contact persons for five or six strong courses, curricula, majors, programs, or centers at your institution that have been initiated or significantly modified since 1966 or so in response to what has been called "the environmental decade." Strive to nominate those programs or activities that you believe to be somewhat special at your institution or unusually effective.*

We also asked ERIC computers, staff, and consultants to identify varied environmental studies-type programs of recognized substance.

After eliminating duplications among types of programs and institutions, we invited some 60 selected deans, directors, or chairmen to summarize "what your program is, what it does, for whom, why, how, where it came from, where it's going, in what ways it is representative of developments in your field across the country, and in what ways it is unique, sources of funding, measures of performance, and so on."

Some programs responded; some did not. The net results of our reconnaisance are presented here, with introductions written by the editors. We believe these 45 case studies to be reasonably representative of types of university adaptations to the upsurge in environmental interest: 1968-1978.

RELATED STUDIES

In some respects this compendium is unique. We have given the broadest possible scope to environmental education, permitting it to encompass undergraduate general studies, varied graduate and professional programs, basic and applied research, and extension and continuing education. Earlier surveys or collections of case studies have taken a somewhat narrower view of the relationship of universities to environmental concerns. We did, however, limit our view to four-year-or-more institutions, two-year colleges having been represented in our earlier Environmental Education in Action—I (ERIC/SMEAC 1977).

The basepoint study is probably the detailed look at Conservation Education in American Colleges by Lively and Preiss (1957). Of the 1024 schools reporting, 55.3 percent were "teaching some conservation," but the instruction was usually specific to one resource, and "a large proportion of the students enrolled in colleges and universities are never exposed to even one course." Proportionately more land-grant universities were engaged in conservation education than were other types of institutions. Neither the authors nor the respondents defined conservation education other than to suggest it was concerned with "wise use" of a natural resource.

Caldwell (1966) speculated that no "really adequate" schools of environmental science and technology existed at the time. His assessment seemed to be born out by a major analysis conducted by the Environmental Policy Division of the federal Legislative Reference Service (1969) in an effort to relate federal science policy to emerging national goals of environmental quality. To 1300 queries there were 500 responses which identified 92 operational programs, representing a variety of approaches to teaching and research applied to national needs. The same year Steinhart and Cherniak (1969) examined in detail 30 such programs in American colleges and universities, and found very few "harboring a faculty with a broad area of expertise." They doubted federal funding policies promoted "the continuity and integration" that are essential to program success. Havlick (1969) early on also inventoried environmental education opportunities at selected institutions, looking for "problem-solving" courses. He felt most liberal arts colleges lacked "the depth to sustain multidisciplinary programs," but found several university examples of "model" programs. The entire Winter 1970 issue of The Journal of Environmental Education was devoted to essays of varying calibre on "the state of the art" in higher education.

In 1971 Aldrich and Kormondy solicited stylized statements from 15 institutions that appeared to "highlight the range of issues that characterize institutional responses to interdisciplinary studies." Their 1973 report to the Conservation Foundation called for a follow-on review of "goals and strategies." To some extent this volume answers that call. Also in 1971, Ragland and Smith surveyed environmental studies programs in the Big Ten universities and Chicago, found seven devoted to such social goals as "the future of man" and "the quality of life," and concluded that their growing pains included adequate funding, questions of tenure, and interdisciplinary curriculum development.

McGowan (1973) speculated that of the approximately 2500 institutions of higher education in the U.S., "only about 50 have environmental programs which are significantly comprehensive and challenging." He was talking, however, only about four-year liberal arts colleges. The programs he cited as particularly successful at the time were those at the (Maine) College of the Atlantic, the University of Wisconsin-Green Bay, (Washington) Evergreen State, Antioch, Colby, Williams, Washington State, San Jose State, University of California-Santa Cruz, and University of California-Santa Barbara. Two years later, after a national EPA survey, McGowan and Kriebel (1975) still weren't willing to raise the number of bona fide programs very much, although they admitted their definition of environmental studies was "stringent." They believed the most successful programs were those "which use the existing disciplines in a creative way" rather than trying to go off on their own.

UW-Green Bay hosted a 92-institution National Conference on Environmental Studies Programs in Higher Education in 1973. The resulting report called for processes and practices expressing "more environmental responsibility" on the part of colleges and universities. The Spring 1973 issue of The Journal of Environmental Education again contained reports from 20 colleges and universities with varying approaches to environmental studies.

The chapter on higher education in McInnis and Albrecht (1975) was limited to a look at the colleges that had attempted to build their entire curriculum around environmental issues. The tearing down of traditional walls that separate the disciplines was seen as presenting "the most significant problem: each individual discipline feels intruded upon and interdepartmental strife crescendos." A report stemming from a 1975 Snowmass Conference on Environmental Education offered broad recommendations for improving environmental education in universities; key words: "total systems," "interdisciplinary," "problem-solving," "action oriented," "broad involvement," "basic educational research." World-wide assessments of environmental education have come from the Office of Economic Cooperation and Development's Paris Centre for Education Research and Innovation in 1973, 1974, and 1976, all reflecting some disagreement among countries on course content, teaching materials, methods, and goals. The 1974 OECD/CERI study yielded a number of comments on problem-oriented research and instruction, typified by: "There is a general difficulty in relating the faculty of a discipline to a problem; either they were not trained in applied problems or they forgot." Pratt (1974) collected case studies of 13 environmental education programs in post-secondary institutions—both universities and community colleges. The only university reports in Pratt not updated in this volume are those from the University of California-Irvine, Michigan State University, and Columbia University.

Unlike ours, most of the previous studies cited have taken as their parameter a particular aspect of environmental studies. Like ours, most studies to date have lacked quantification and precision, but then the very field of environmental studies is difficult to computerize without castrating the subject. However non-generalizable it may be, our anecdotal research at least gets below the level of bare statistics and into the operational nuts-and-bolts of very varied environmental studies programs that reflect varied institutional missions, varied perspectives on environmental problems, and varied educational approaches to teaching, research, and public service.

The very diversity of programs and perspectives may indeed be a sign of a healthy environmental studies "ecosystem." As Colley (1977) says: "We have each approached this new field with our own specific backgrounds and education, and differences are not only to be expected but encouraged. It would be a deadly field if we all agreed with each other and took the same approach."

THE CAMPUS SETTING

For identifying public choices in resource management and for supplying the economic and ecological facts as well as the esthetic appreciations on which to make intelligent decisions, perhaps no instrument of American society was potentially better equipped in the 1950's than the university. The university had basic research and teaching skills. The university was relatively objective. The university at the time had growing resources. Yet the existing posture of the university was not optimum for the task of entering the environmental era. The university had become composed largely of highly individualistic professors organized principally into departmental enclaves, each marked increasingly by the breakup of knowledge into little pieces, with what Veysey (1965) called an accompanying "maiming and mutilation of the mind." The university had a number of disciplines concerned with "conservation," yet each had an essentially narrow approach. Some departments had in effect taken out a patent on the term, defying colleagues of any other stripe to trespass. Some departments had fenced off the field as a preserve for basic research sans application. Other departments sometimes rushed out with action programs where experts feared to tread. Still other professors failed to recognize the extent of their connection to the matter at all. "Environmental" engineers had discovered that term, but to them it meant only the technology of heating and air-conditioning.

There were exceptions, of course. Some natural resource management schools, some ecology programs, some economics and political science departments, and even one law school had strong environmental tilts. A few liberal arts colleges had put together what in effect were environmental studies curricula. To some geographers particularly, conservation had broadened to be "more ethics than economics" (Weaver 1959).

On the whole, however, universities for 50 years had both influenced, and been influenced by, the centrifugal forces inherent in the conservation movement. What patently were needed were university postures and instrumentalities that would influence, and be influenced by, the centripetal trends inherent in environmentalism. They began to emerge, because universities inevitably reflect changes in their environment (Schoenfeld 1967).

While the mass media were the midwives of the environmental movement of the 1960's, the campuses were its cradle. The college and university impetus took two forms. First, the early-warning radar voices of environmentalism were invariably those of professors—the Allens, Bouldings, Caldwells, Coles, Commoners, Dasmanns, Dubos, Ehrlichs, Hardins, Leopolds, McHargs, Odums, Rienows, Strongs, Whites, and others. As Leopold once put it, an ecologist lives in a world of wounds; the ecologists began to cry out in strength in the '60's. At the same time, in quiet faculty committees there were emerging the prototypes of the environmental studies courses, centers, institutes, projects, and programs that were to proliferate in the '70's like mushrooms after a spring rain. Today no self-respecting campus is without some gesture toward environmentalism, and the more substantial enterprises represent a major departure in university focus and format toward interdisciplinary, multi-function, problem-oriented teaching, research, and outreach (Schoenfeld 1971), as the case studies in this collection attest.

Barring English composition and math, few university subjects are being offered today in so many diverse ways and places, by such a mixture of schools, departments, and professors, as that complex of cognitive content and affective process known, precisely or not, as environmental studies. The latest definitive book on the subject concludes there is "no clear, single answer" to "what makes education environmental" (McInnis and Albrecht 1975). Certain broad characteristics of environmental studies are clear, however.

DEFINITIONS AND DELINEATIONS

To describe the university's efforts in the 1960's to come to grips with the degradation of man's interlaced surroundings, the term "environmental studies" increasingly entered the lexicon of the campus. Some said the term sprang into being merely at the whim of phrase-makers, or to lend a charismatic quality to the matters with which it was associated. Increasingly, however, the term, or related terms, was widely adopted to describe, if not a new discipline or set of disciplines, at least a new way of looking at a variety of old disciplines, their relationships, and their potential contributions to environmental management broadly defined.

Characteristics of Environmental Studies

While no pinpoint definition or delimitation of the term "environmental studies" is possible even now, and indeed may never be desirable, we can at least list the factors or criteria that seem to be implicit in its use by most institutions of higher education.

First, we are concerned with the environment of humankind. It is possible, of course, to study the physical nature or the biological characteristics of the environment on an infra-human basis, but the concept in environmental studies is the study of humans as they affect and are affected by their environments. The focus, in addition, is upon the growing numbers of humans concentrating in increasing densities and bringing greater pressures to bear upon the environment. Yet our emphasis on the environment of humankind rejects a shopworn "utilization" approach. Perhaps "the most distinguishing characteristic of environmental studies is their recognition that the welfare of the total environment may require a subordination of the parochial interests of humankind" (Nash 1977).

So, we are concerned with the total environment: its social, cultural, economic, and esthetic, as well as its physical and biological, aspects. To seek an optimum total environment requires both an understanding of human needs and the needs of a healthy living natural environment. Any disqussion of the goals of society must quickly draw upon a knowledge of the nature of the world people live in, just as any discussion of a balance of nature today must take into account the necessary impingements of humankind. In a following chapter, for example, Gold defines environment as "the system of interrelationships among society, economics, politics, and nature in the use and management of resources."

Third, we are concerned with interdisciplinary programs. The development and management of an optimum total human environment requires an understanding of the contributions which can and must be made individually and collectively by all the arts, sciences, and professions. For example, Bryson (1970) suggested that to deal effectively with the complex relationships within the biophysical environment, and their political, social, and economic consequences, a high degree of integration of intellectual efforts was necessary. He concluded that reforms could be accomplished by increasing environmental content within established disciplines and developing comprehensive interdisciplinary programs of teaching and research.

Fourth, we are concerned with problem-solving programs, as opposed to "ivory tower" studies—programs that have as their ultimate rationale the clarification of open-ended options for environmental protection, rather than short-term "solutions" that may actually degrade the environment. We are concerned with the designed adjustment of time and space for optimum human performance within the carrying capacities of the environment. The desired objective is to bring conflicting forces into functional relationships, resulting in a unity called order, an order where human impact does not needlessly destroy environmental solvency and where environmental solvency contributes to more fruitful human life, liberty, and the pursuit of happiness. The environmental imperative "is a combination of pragmatism and spirituality, summed up in the practical conviction that man cannot survive as a civilized being unless he reaches an accommodation with his natural surroundings" (Oakes 1977).

Finally, while we recognize the essential importance of strengthening existing disciplines, we look toward teaching, research, and service configurations that will transcend traditional lines of endeavor, and be concerned with the wholeness of the relationship between humankind and the total environment. What we seek is integrated environmental management based in the scientific method and expressing ethical dimensions.

Distinctions from Environmental Sciences

Environmental studies can encompass, but are not synonymous with, the environmental sciences. The latter are the biophysical "hardware," so to speak, of environmental studies, in contradistinction to the social science and humanities "software." More explicitly, the environmental sciences include such diverse fields as "meterology, climatology, plant and animal ecology, oceanography, agriculture, geochemistry, soil engineering, civil engineering, and many more" (Lapedes 1974).

The environmental sciences, of course, play a major role in any environmental studies program, but only one role. To address any environmental problem at its root is to deal with the fundamental cause—man and his ideas. Indeed, "the conclusion cannot be avoided: science, undiluted with ethical and humanitarian influences, can be mankind's greatest problem rather than its greatest blessing" (Nash 1976). A rampant technology is an aspect of many current environmental problems, and engineers and scientists must share in the blame (Hirst 1977). Environmental studies seek to bring perspective to both the sciences and the arts.

"The future obligation of science is to understand the generalities of the man-environment relationship, as well as the specifics," Ross (1977) writes. "The specifics alone are not enough." Many environmental science programs today fill the Ross prescription, of course.

Relationships with Ecology

If only because "eco" is a handy tool for newspaper headline writers, the term "ecology" has often been bastardized into a synonym for environmental studies and even for the whole of the environment. But ecology was not born on E-Day, 1970; its history is long. Egerton (1976) has traced "extensive ecologically relevant accounts" in the literature of exploration from the three centuries before 1800. The term itself was coined by a noted German biologist, Ernest Haeckel, in 1866 as a label for "the whole science of the relations of the organism to the environment, including, in the broad sense, all the 'conditions of existence'." If textbooks are any evidence, by the 1920's four distinct ecological sciences had emerged in the United States: oceanography, limnology, plant ecology, and animal ecology. Social ecology was not to be recognized in any formal sense until the 1960's (McIntosh 1976), although earlier, at least Gaus (1947), a political scientist, wrote of "the elements in the ecology of an institution or movement," and Cutlip and Center (1952) talked about "the ecology" of the rise of the public relations profession.

Two near-revolutions overtook the ecological sciences in the 1960's. Big money and big computers brought a switch at least in part from what has been called qualitative "car-window" research to quantitative mathematical ecosystem modeling. And the rise of the environmental movement projected ecologists into the public arena, or perhaps it was vice versa. Today, while all sciences contribute to the factual describing of the universe in which man functions, it is interdisciplinary ecology that integrates the information available into an understanding of the ecosystems of which man is a part, which he in part creates, which he can readily destroy, and the rules of which he must live by however he manipulates them (McIntosh 1976). Leopold (1949) expressed all this eloquently in his "land ethic," and there have followed ecological spinoffs into philosophy, public health, history, art, literature, psychology, sociology, and other disciplines—the array of environmental studies.

In the more philosophical meaning of ecology, it is a way of looking at things—a viewpoint that sees not the things themselves so much as their connections with other things, with the myriad of mechanisms and processes that make up the web of life—of mice, men, and mountain laurel. In this eyeball shift from thing to process, we recognize that the human observer is an integral part of the picture, for good and for ill (Fabun 1970). The "new ecology" has even been called "subversive"—a "resistance movement" against environmental degradation (Shepard and McKinley 1969). While card-carrying ecologists are still found principally in botany and zoology field stations, at least one university now has a large department of social ecology, California at Irvine, with its roots in the traditional disciplines of sociology and psychology. (This use of the term is not to be confused with the "human ecology" centers once subsidized by the CIA to test mind-blowing drugs.)

Links with Environmental Education

Some persons consider the terms "environmental studies" and "environmental education" interchangeable. Others might say environmental education is the process of acquiring, and applying, the content of environmental studies. While there is by no means a total concensus on a working definition of "environmental education," the one that would probably get as many votes as any among professional environmental educators might be that evolved from a recent Belgrade conference under UNESCO (1976) auspices:

> Environmental education is a life-long, multidisciplinary approach to teaching, mass communication, community participation, or some other strategy or combination of strategies aimed at the development of a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones.

At many universities, environmental education is the province of the school or department of education, while environmental studies "belong" to all the other schools or colleges. The distinction may be handy, but it may be unfortunate, too.

THE ENVIRONMENT OF CHANGE

It is difficult to say exactly when the word "environmental" became associated with the words "studies" or "education." The "environmental sciences" had been around for some time in the 1950's, but the connotation was always of the biophysical sciences exclusively. Today's Journal of Environmental Quality, for example, is a house organ for the American Society of Agronomy. "Conservation" was the original accepted term for general university studies in resource management. When the President of The University of Wisconsin formed an all-campus faculty committee in 1961 to develop a new interdisciplinary course on "the role and importance of resource use planning for the future," the committee set out to outline a course in what it initially called "conservation." But when the course was first presented in 1966-67, it was listed as "Environmental Resource Management Principles and Problems." Somewhere along the line the "environmental" rubric has entered the ken of committee members. Computers (Swan 1975) will tell you that the first time "environmental" and "education" were linked in a scholarly journal was in the September, 1968, issue of Educational Record, in an article on "Environmental Education and the University." But since the senior editor of this volume was the author of that article, he knows he did not invent the term.

The Emergence of the Environmental Approach

As early as 1947 the National Society for the Study of Education had recognized the need for an environmental floor under science teaching, at least in the elementary schools:

> It is important to realize that from the point of view of children, science has few artificial boundaries. In observing and interpreting the phenomena of the environment, children are not likely to categorize happenings in terms of the special fields such as astronomy, botany, or chemistry. It seems logical, therefore, to select curriculum materials on the basis of the environment.

The specific term "environmental education" was probably first introduced by Matthew J. Brennan, Director of the Pinchot Institute for Conservation Studies, speaking to the American Nature Study Association in 1964 (Schoenfeld and Disinger 1977). By May 1968, a National Conference on Environmental Education had been held in New Jersey. By the fall of 1969 there had appeared the first issue of The Journal of Environmental Education. The federal Environmental Education Act shortly followed.

In general it was elementary and secondary school people and resource agencies that adopted the term "environmental education," usually as a substitute for "conservation education," although in 1968 the national Conservation Education Association refused to switch, leading to the birth of the National Association for Environmental Education. While schools and colleges of education developed courses in environmental education pedagogy and research, universities themselves tended to adopt as their umbrella term the rubric "environmental studies." So early as 1966, The University of Wisconsin, for one, had an all-campus faculty Committee on Environmental Studies, charged with encouraging "interdisciplinary studies that have as their orientation the discovery and dissemination of those attributes of the environment which will contribute to man's survival in a civilized state and to his progressive biological and cultural evolution." Committee action led to the organization of an Institute for Environmental Studies, linked to five UW colleges and a score of departments. By 1966, too, environmental studies had the first of what was to become a flood of textbooks—Future Environments of North America (Darling and Milton), growing out of a 1965 national conference on "harmonizing the works of nature and man."

While some may see a persistent logomachy between "studies" and "education," the distinctions are more apparent than real. Although the main title of this compendium, for example, is Environmental Education in Action, the compatible subtitle speaks of "Environmental Studies Programs" in colleges and universities.

Attributes of Environmentalism

It is probably worth emphasizing here, however, that there *are* important distinctions between the "old conservation" and the "new environmentalism." In terms of its *scope*, environmentalism attempts to be multi-faceted. Whereas yesterday we tended to treat soil conservation, water conservation, wildlife conservation, urban engineering, and so on, as separate pursuits, today we try to understand, relate to, and adapt to the ecosystem unity of all humankind-environment relationships. In terms of its *focus*, then, while environmentalism is humanity-centered, while our primary concern has shifted from the survival of remnant redwoods and raptors to the survival of the human species itself, yet the shift has been accompanied by a new-found recognition that "any concern for human welfare must encompass a concern for the total environment of which humankind is a part, not apart" (Nash 1977). In terms of its *locus*, while the old conservation conjured up images of open country, environmentalism incorporates the pressing problems of the city. In terms of its *political alliances*, conservation was linked to such orthodox causes as depression pump-priming, national defense, and outdoor recreation; the new environmentalism, on the other hand, owes allegiance to neo-Malthusian population control. It is in its basic *cultural orientation*, however, that the new environmentalism differs most strikingly from its antecedent, conservation. The latter stood clearly for economic development, for the infinite goodness of "progress." Pinchot himself said so (1947). Environmentalism, on the other hand, reflects a growing suspicion that bigness is not necessarily better, slower may be faster, and less can be more. While we are concerned about quantities of natural resources, we are also concerned about the quality of the human experience. Davies (1977) sees the old conservation issues as "pork-barrel" distributive issues; they involved the government in subsidizing some segment of American society. The new conservation, on the other hand, places far more emphasis on government regulation, on government control of the behavior of certain groups, "particularly industrial polluters and commercial developers."

All these attributes of environmentalism are reflected in environmental education or environmental studies, however defined. The two share common denominators. First, there is a hard core of ecological *content*. Second, a recognition of worldwide problems of *crisis* proportions. Third, a component of *conscience*, of a value system. And fourth, a *commitment* to private and public action. The whole is focused on a *comprehensive* rather than a compartmentalized approach to change in people-land relations, be they open-country or urban. Frequently there is added an element of *career* education.

A basic message of environmental education or environmental studies is *interdependence*—that everything is connected to everything else. That is "the principal intuition of the 20th century" (Perlinski 1975). The practical problem lies in how to recognize and effect sound, fair trade-offs among energy, economy, and environment.

The broad aim of environmental teaching is to enable people to recognize the factors which determine the nature and quality of the human environment so that all may respect and appreciate it to the full, and participate constructively, as individuals and as citizens, in its management and development. From it, participants must learn, in broad terms, four things: to identify, and observe more accurately, the many components of their environment; to understand the interrelationships and interdependence between these components and themselves; to evaluate the aims and environmental consequences of their activities; to act, directly and indirectly, in a manner which will ensure the maintenance of a harmonious relationship between man and the world in which he lives (Smyth 1977).

The tone of much environmental education is changing. Once marked by "doomsday visions," it now reflects more faith "in the inventiveness and creativity of Americans as problem-solvers" (MacDonald 1977). We have become "suspicious of environmental gurus with solutions to all problems;" we now know there are no simple answers, only tough alternatives (Mayer 1977).

The outlines of a constructive "North American environmental ethic" were postulated at a recent prestigious national environmental education seminar (Aldrich, Blackburn, and Abel 1977):

*Plan for qualitative growth rather than quantitative growth.

*Move from an age of rapid energy consumption to an age of energy efficiency.

*Maintain environmentally sound options as one guarantee of the freedom of the individual.

*Recognize that short-term economic gains may not be worth the price paid in long-term ecological health.

*Question the "right" of the American citizen to use as much of the world's resource as he or she can afford.

In sum, the seminar participants agreed "we must redefine the pursuit of happiness," but not abandon the pursuit.

The Ecology of Environmental Studies

It is unsophisticated, of course, to think that environmentalism "burst upon the scene," so to speak, in the 1960's. The antecedents of environmentalism as a concept were many, going back at least to George Perkins Marsh's Man and Nature in 1864; as a political force, environmentalism inherited the infrastructure of a number of strong conservation organizations, some of which had been operative since the early 1900's. Yet, just as there were qualitative differences between the old conservation and the new environmentalism, so did public awareness, interest, and even support take a quantum leap at the turn of the decade, epitomized by the passage of the National Environmental Policy Act in 1969 (Liroff 1976).

What triggered the mass irruption of environmental studies on college campuses across the country? Even from the perspective of history we are still not sure what inspired the rise of the earlier conservation movement at the turn of the century. Did it take its impulse largely from a technocratic gospel of efficiency (Hays 1959), or from a populist revolt against wasteful monopolies (Bates 1957), or from an evangelical concern for Nature's vast, pulsing harmony (Muir 1901)? Probably from all three. Gaus (1947) identified the critical elements in the "ecology" of any institution or movement as "people, place, physical technology, social technology, wishes and ideas, catastrophe, and personality." A brief examination of these factors at work in and on the campus in and around 1970 may help explain the emergence of environmental studies.

American people—students and professors alike—had been on a decade-long emotional trip that had left them both frustrated and pent up: multiple assassinations, civil rights confrontations, Vietnam, cost of living, crime in the streets, campus sit-ins—as F. Scott Fitzgerald once described a somewhat similar era, "all gods were dead, all wars fought, all faiths in man shaken." We were ready for a cause we could believe in. It was natural that the new conservation would supply it. Ever since we first dropped anchor off Plymouth Rock, Americans have turned periodically to Nature for inspiration and challenge.

Yesterday's environmental degradation was usually over the hill and far away—in somebody's else's dust bowl, somebody else's canyon, somebody else's boundary water canoe area, somebody else's forest. But the place of environmental degradation in the 1960's was where most people live—in the foul air, fetid water, and clogged arteries of the city. Millions could smell, taste, hear, and see the problem now, often in college halls themselves.

The physical technology of the 60's had vaulted us to the moon, and thus had given us renewed confidence in our capacities, but from our new vantage point in the cosmos we looked back and were struck as never before by the fragile, finite character of Spaceship Earth. By invading one new frontier we rediscovered another, a state of harmony between humankind and Nature.

Continuing along the Gaus outline, developments in the social technology of the 60's played a signal role in the rise of environmentalism. The voice of the mass media had become increasingly dominated by a relatively small coterie of paperback publishers, magazine editors, and TV commentators. When these communication gatekeepers almost simultaneously seized on the pesticide-population-pollution syndrome as the big story, the message was inescapable. Beginning with Rachel Carson's Silent Spring in 1962, on down through Arthur Godfrey's "Portable Electric Medicine Show" in 1972, the mass media brought ecological awareness into America's living rooms and classrooms. The

1969 National Environmental Policy Act energized press coverage of environmental impacts. Wisconsin newspaper reporters and editors testify that by "officializing" environmental issues, NEPA and its spin-off in that state have given the press new hooks on which to hang environmental coverage (Holcomb 1977). Asked to identify how they first "became aware of environmental problems," a large plurality of a cross-section of University of Wyoming undergraduates checked "the news media" (Bowman 1977).

In their wishes and ideas, all the great ecological philosophers had always said that true conservation would require a profound change in American values. Few people listened. But in the 60's the youth of the country began to understand, if only because it matched a wave of anti-materialism sweeping their ranks. Perhaps nothing so accounts for the current popularity of environmental studies as this marriage of orthodox ecological ethics and the innate iconoclasm of the young, coupled with their commitment to the tactics of confrontation.

There was no single, Pearl-Harbor-type catastrophe responsible for the rise of environmentalism, but there were multiple mini-catastrophes: death-dealing smog in the east, oil spills in the west, water pollution in the north, fish kills in the south—there was no place to hide any more. Once bucolic retreats, the campuses themselves had become cement monotypes.

No single national personality—no Dewey, Jordan, Butler, Eliot, or Harper—spearheaded the move to environmental studies, just as the environmental movement itself had no single leader in the Teddy Roosevelt mold. On many a campus, however, a local leader or cadre of leaders came to the fore. What was striking was the diversity of their backgrounds. There was scarcely a discipline that did not produce on some campus a chairman of an environmental studies committee. Such diversity has lent a unique "personality" to the environmental studies "ecosystem," and speaks well for its stability and longevity.

Out of the changing people, places, technology, aspirations, fears, and personages of America and its universities at the turn of the decade came a spirit and new curricula. The spirit was an embryo ecological conscience. The curricula were an attempt to give that conscience substance and application.

From the sentiments and scenes of the 1960's the broad realization has grown that humankind itself is a part of the environment, that our welfare is at stake, and that it hinges upon the welfare of all other things, animate and inanimate. For thousands of years people had gone forth to multiply and subdue the earth as a chosen species; now that premise has come under examination. There has emerged a more ecocentric view of life, a recognition that we must ameliorate our impacts on the environment by knowing before we act what they are likely to be (McInnis and Albrecht 1975). Today, environmental education "seeks a rather fundamental reordering of thought and action away from growth, control and mastery over nature, and progress traditionally defined, and toward an ecologic ethic and different definition of 'quality of life' than that which has incurred such environmental cost" (Miles 1976).

Whatever their family or genus, no environmental educator today is so naive as to believe modern humankind will necessarily achieve complete harmony with the natural world any more than we will surely achieve world justice or liberty for all people. In these higher aspirations, as Leopold (1947) wrote, "the important thing is to strive." The capacity to live without befouling and denuding the environment—this was Leopold's (1933) test of whether we are civilized. Environmental teaching, research, and extension can be one of the means of developing a culture that will meet this test.

The Varied Goals and Needs of Environmental Studies

To support and sustain the third American revolution—the search for environmental solvency—we needed new integrated programs that would discover, disseminate, and apply the ecological and economic facts, engineering techniques, and esthetic appreciations basic to an applied conservation conscience. Each American institution had to adjust itself accordingly. The implications for our institutions of higher education were particularly clear. The energies of the campus had to be so redirected that environmental management could share in the skills and resources the university could contribute to the solution of public problems, and the university in turn could profit from the stimulation that comes from confronting a pressing public issue.

About how best to involve the university in a broad strategic campaign against the pervasive degradation of the American environment, there was considerable discussion and experimentation. Because goals vary, institutions vary, traditions vary, perceptions of problems vary, and terms are imprecise, there is still a lack of concensus. The aspects of the problem defy easy pigeonholing. They keep slipping out of the discrete departments into which universities tend to be organized, and out of the tight compartments into which action agencies tend to consign their tasks.

One approach, for example, would be to examine environmental studies from the perspective of university organization. The trouble here is that the problems of environmental solvency defy the traditional pattern of the division of labor within the university which arranges knowledge into a series of subject matter areas concerned with segments of the physical, biological, and social sciences, and the humanities. Another approach would be to examine environmental studies from the perspective of such conservation objectives as outdoor recreation opportunity, water quality and supply, forest and field yield, urban beauty, energy supply, and so on. The trouble here again is that conflicts among competing resource demands are frequent and intense, and it becomes increasingly difficult to draw any clear quantitative or qualitative lines among the problems. For example, as Caldwell, Hayes, and MacWhirter (1976) point out, a controversy over a proposed nuclear power plant at Bodega Head, California, in 1958-1973 was simultaneously an energy, land use, and coastal zone issue, with economic, institutional, and esthetic implications. Each specific resource use raises a congeries of questions about humankind's relationship to the total environment, and the choice of alternatives among competing resource uses involves legal, economic, social, administrative, technological, esthetic, ecological, and ethical considerations which in turn span manifold governmental agency and university department lines (Cooley 1966).

Any attempt to dissect environmental studies indeed ran the risk of so mutilating the specimen that it lost its essential characteristic—its multidisciplinary, multi-process nature. Yet it was necessary that we collate its contents and goals in some way if we were at least to agree on what to disagree. One approach was simply to ask the question:

> With respect to environmental studies, what are the needs and demands of the market for the goods and services of the university?

The university engages in basic research, and in applied research and development. The university supports elementary and secondary education, and supports and may even engage in two-year-terminal vocational training. The university performs undergraduate instruction, professional education, and advanced scientific training. The university engages in formal adult education, informal counseling, and extension services. Environmental education has come to be an aspect of all these levels of enterprise.

New Knowledge and New Knowledge-Seekers. The conservation, redevelopment, and maintenance of environmental solvency requires more knowledge than we now possess. The things we do not know about the biosphere and its denizens are staggering. At the level of fundamental knowledge, we are desperate for criteria and tools with which to measure environmental solvency in an ecological sense and in an economic sense. At the level of technology, we lack means and ways of abating, restoring, controlling. Actually it is rather fruitless to worry whether the research to be performed is termed basic or applied, whether we start with a stated requirement and proceed to a solution or start with a concept and proceed to an application. The important thing is that we ask the right questions; in other words, that the research be cast in a problem-solving climate—the problem being the achievement of environmental quality and energy conservation. Much of such research has been initiated by existing university departments; some has required development of hybrid departments or at least of special task forces. Again, it would seem fruitless to worry about the "home" of the research. The important thing is that each scholar, regardless of his stripe, accept a redefinition of his role and his conceptual approach that recognizes the problems of the environment and their interdisciplinary nature.

Intimately associated with the university's search for new environmental knowledge is of course the graduate training of researchers equipped to fill the public and private stations where environmental studies will be pursued in the physical, biological, and social sciences, and the humanities. How in fact to train such scholars in a more productive cross-fertilization of ideas poses a vital question for the modern university. Clearly the watchword of environmental studies is the production of multidisciplinary knowledge and multidisciplinary knowledge-seekers (Michael 1974).

More and Better Professionals. The conservation, redevelopment, and maintenance of environmental solvency requires more managers or operators better equipped to apply present and emerging knowledge. At least three broad types of professionals can be identified. First, there are the resource technicians like park managers, geologists, ecologists, meterologists, foresters, geographers, economists, sociologists, architects, hydrologists, game managers, engineers, and so on. Not only must they be well grounded in their specialty if they are to be immediately employable, but if they are to be promotable they must be able to relate their discipline or function to that of other professionals and to the larger questions of human values and environmental policy. Second, there is the need for the broad resource generalist, perhaps the rarest of all species, who can deal effectively and creatively with whole policy issues in all of their complexity in a staff or executive role. Third, there must be "change agents" equipped with an understanding of the interrelationships involved between their callings and total environmental management, and with a knowledge of the tools of the trade in energizing land and water use controls—lawyers with pertinent legal skills, designers and planners with a grasp of resource policy implementation, communicators and educators equipped to interpret resource problems in such a way as to achieve consensus rather than conflict.

In the production of new professionals, are we talking about 4-year, 5-year, or 6-year programs? Do we start with generalists and make specialists out of some, or do we start with specialists and make generalists out of some? Do we modify, expand, broaden, intensify the curricula of existing departments and schools, or do we invent custom configurations? These are some of the questions still agitating the university as it faces the training of environmental technicians, public policy formulators, and change agents.

One promising form of environmental management training involves the bringing back to the campus of operational personnel for more specialization or more broadening, depending on the needs and goals of the selected individual. Such programs may be of the non-credit professional refresher type, or they may involve the granting of advanced degrees. Whatever the type or level of professional environmental management education, the product should be specialized enough to be viable in field operations and broad enough to appreciate the complicated biotic and human phenomena over which he or she presides. It is no small challenge.

In a freshman-level "Geography of Man's Environment" course at Southern Illinois University, Horsley (1977) has been able to "significantly alter environmental behavior positively" by applying a battery of techniques based on "social learning" theory. Whether due to formal educational experiences or not, today's college students are "deeply committed to environmental quality" and acknowledge that "fundamental cultural values have been a basic cause of ecological problems" (Bowman 1977). Kansas adults in general, on the other hand, express "a relatively low level of dedication to environmental protection" (Althoff and Greig 1977).

Citizenship Education. In the final analysis, environmental management will proceed only as far and as fast as public opinion will sanction. The university can assist in three ways in the achievement of a mass conservation literacy. First, in its undergraduate education it can confront all students—not just career majors—with the kinds of resource management conflicts about which as citizens and voters they will render crucial judgments; it can attempt to instill a desire for constructive change; it can suggest biosocial standards of values, and it can offer practical guidelines to action. Second, the university can assist the public schools in the development of K-12 scope and sequence concepts and materials that will lift conservation education out of any rut of irrelevant or inadequate approaches and techniques. Third, the university can assist two-year terminal technical institutions in developing sound curricula for the field aides who must increasingly be produced to fill sub-professional positions in resource management agencies of many types.

Technical Counsel and Services. Growing national programs of environmental management depend increasingly on regional and local initiative and responsibility. It is only at the intra-state level that most federal policies can be translated into public and private practices, yet it is at this level where the forces of wise resource management continue to be ill-equipped to deal with the forces of exploitation. The inefficiency with which public agencies and private citizens go about performing the socially essential tasks of environmental housekeeping stem largely from the fact that the technical and organizational skills available to the resource conserver or rational planner are normally inferior to those available to the environmental exploiter. In its traditional extension mode, the university can reinforce local leaders with improved educational materials and professional consultation on environmental solvency. While we continue to search for more environmental facts and to train more environmental managers, we can help apply what we already do know by rifling skills and resources to the local level. Those contending for environmental solvency need data to show that economically we can afford such surroundings and that biologically we cannot afford anything less. The facts and techniques need to be made applicable and available in localities where the problems exist and where the issues are fought. Local leadership needs a fund of information and special talents on which to draw, including the effective stimulus that would come from knowing the experiences of other leaders in other communities who have met and overcome some of the common problems. Interdisciplinary teams of university extension personnel can collect, collate, and disseminate practical guidelines to community organization and action in land and water use controls and energy conservation.

Problem Solving. Broadly stated, the goal of environmental studies, then, is to understand and alleviate environmental problems. What might be considered the three most pressing such problems today?

Probably the No. 1 recognized problem is the mounting world population. World population increases about five people every two seconds, 150 people every minute, or 220,000 per day. It takes more and more nonrenewable and renewable resources to sustain all these people. They must have food, clothing, and shelter. This requires developing and using resources which in turn results in many environmental impacts. The second major problem lies with adequately feeding all the people of the world. There is a problem of both quality and quantity of food. Each year we move closer toward mass starvation in many parts of the world. The third problem deals with energy. The demand for energy keeps rising each year along with the increasing population. The developing countries are making every effort to industrialize and raise their standards of living. That requires resources and it requires energy. Can we produce enough energy to keep up with demand? Energy is now recognized as a basic need like food, clothing, and shelter. We cannot do without it. "We are not doing enough about population, food, and energy problems and they are all interrelated. We must face up to the population problem, develop alternative sources of energy, and adopt strict conservation policies for food resources" (Wert 1977).

Fortunately outlines of energy education (Allen and LaHart 1977; Allen, LaHart, Dawson, and Patterson 1977), population education (Roberts 1977), and food production and conservation education (Jenkins, Owens, and Heffner 1977) are emerging. Whether such programs emphasize sufficiently a fundamental point is another question. The point:

> If you have an annual growth in energy consumption of 6 percent, you double the consumption in 11-plus years. (Energy consumption is just an example of a growth category; it could be population, or GNP, or wheat, or copper.) If you continue that rate you double again in another 11-plus years. Thus, in 22-plus years, the consumption increases four-fold, and so does the environmental-pollution impact. At a certain point on this curve you begin to get non-linear responses. The curve itself is non-linear. You pass certain thresholds, where the reactions are fundamentally different. People tend to say, "Look around us. It isn't so bad. So we can continue the way we're going." In their minds they are thinking of a plateau, even though it is a high plateau. But we are climbing the Sierra Nevadas, and it is harder to take a step at 14,000 feet than it is at 8000 feet. In some categories of resources we are reaching the 14,000-foot level. There is, of course, the

> concept of technological substitution. That works if you can continue to plug in technological substitutes, which we are doing, but we don't understand all the interconnections, and some of them are negative surprises. So the issue is, what will the pressures be, what will our environment be, at the end of the century in 22-plus years. This stretches the traditional concept of conservation. It is not a question of conserving what we have or reconstituting some earlier conditions. The question is whether we will be forced to yield ground, much further and at a much faster pace than we now realize or admit (Ross 1976).

Complicating our attack on real problems are intermediate problems: vacillating public support for environmental action (Quarles 1976), the "iron triangle" of vested interests embracing lobbyists, congressional committees, and middle-level federal bureaucrats (Whitaker 1976), Americans' profligate way of life (Sansom 1976), "overwhelming commitment to technology" with its miscarriages of production that lead to pollution and waste (Mumford 1974), and a halting recognition of the Biblical injunction that man was put in the Garden of Eden to "dress it and keep it" (Dubos 1975).

A Federal Role? While it would be nice to think that the university would or could engage in a self-energizing program of environmental studies of adequate scope and depth sans outside help, the fact remains that in the absence of foundation or federal funds such is likely not to happen, particularly in the presence of federal support for educational programs that actually mitigate against the development of interdisciplinary research, teaching, and extension focused on environmental solvency. Federal funds, for example, support some water pollution abatement research that is too unilateral; they support some highway engineer training that is too narrow; they support some agricultural extension work in environmental degradation; they support elementary and secondary education programs that have nothing to say about conservation. Until Congress reviews its broad authorizations and appropriations for water management, agriculture, transportation, and urban redevelopment in the context of environmental goals, and particularly until Congress invests specifically in rigorous environmental studies, it is unlikely that the universities will have the will and the way to change the picture before substantial sectors of our environment reach a state of perturbation which will be difficult if not impossible to correct at reasonable cost and within reasonable time limits.

Unlike the "new math," international "area studies," exotic languages, and other force-fed programs, environmental studies were not primarily the products of federal or foundation sticks or carrots; they were self-sown. Now that they are in place, they are attracting some foundation recognition. The Rockefeller Foundation's new Fellowships in Environmental Affairs, for example, call for "a mix of biological, economic, social, and physical science considerations intertwined with engineering, legal, political, humanistic, and administrative concerns integrated through sound environmental policy formation and implementation" (Richardson 1977). But such support is in short supply.

In sum, we probably need a federal Environmental *Higher* Education Act which will state unequivocally a commitment to environmental research, teaching, and extension, and provide segregated funds. The rationale for such an Act would be simple: it is unthinking people who pollute and exhaust the environment, and it is thinking people who can bring about environmental conservation, redevelopment, and maintenance.

The Impact of Environmental Studies on the University

As evidenced in this book by the widespread emergence of discrete courses, programs, majors, centers, and institutes under the rubric of "environmental studies" or related terms, the environmental movement of the late 1960's and early 1970's has had a measurable impact on college and university organization and offerings across the country. But what is not clearly so evident is the more subtle influence of environmentalism on the warp and woof of traditional schools and colleges within universities, and particularly the solid role of environmentalism in breaking down barriers among conventional disciplines to produce cross-discipline undergraduate classes and graduate research seminars.

While some of that influence may have resulted only in cosmetic changes in course descriptions and college catalogs, the evidence suggests a reasonably profound and relatively rapid adjustment of substantive offerings to the impulses of the environmental decade. To be specific, at one representative state university, course titles with an environmental tilt have risen in number by 443 percent between 1965-66 and 1975-76, not counting the even more subtle changes in the contents of courses sans changes in titles.

The year 1965-66 is an appropriate base-point for such an analysis because it was not until 1968 that a report on "Environmental Education and the University" first appeared in the literature. The year 1975-76 is, obviously, a ten-year benchmark. The University of Wisconsin-Madison is the representative institution.

To determine our figures, what we did was admittedly relatively crude. In each of those years, we counted all of the courses in the first-semester, second-semester, and summer session timetables in whose titles were included the words *ecology*, *ecological*, *environment*, *environmental*, or *energy*. Those terms would clearly not identify all courses with an environmental tilt, and might identify some not truly environmental in their scope or content. The approach also is vulnerable to any tendency on the part of professors to seize on the popular nature of the terms concerned to lend allure to otherwise pedestrian presentations. But by and large the identifiers are a reasonably accurate clue to the impact of the environmental movement on school and college course offerings at UW-Madison.

In the first semester, environmental-tilt courses rose by 480 percent from 10 in 1965-66 to 58 in 1975-76; in the second semester by 375 percent from 12 to 57; and in the summer term by 900 percent from 1 to 10.

While some of the striking trends at UW-Madison can be accounted for by the emergence of a School of Natural Resources in the College of Agricultural and Life Sciences and of an independent Institute for Environmental Studies, it is particularly significant how widespread was the change among the various schools and colleges, as indicated by Table I, and how common was the practice of cross-listing the courses among sister departments, as attested by the chart's fractional figures.

How the use of only five code words masks important trends is attested by the fact that, while on the chart the Law School shows the development of no environmental-tilt courses, as a matter of fact the UW-Madison Law School has become heavily committed to environmental law instruction under the rubrics of "Water Rights Law" and "Land Use Law," neither of which would show up in our survey. Just so, a History course that has been on the books for years under the title of "The History of the West" has not changed its title but has become in part "The History of the Rape of the Public Domain." To identify all such nuances would take an analysis well beyond the scope of this reconnaisance.

It has sometimes been said it is easier to move a cemetery than to move a university faculty and its curriculum. The data presented here suggest, quite the contrary, that a representative university has been markedly responsive to public needs while maintaining responsibility for academic standards. Whether this impact of the environmental decade on higher education will survive is, of course, another question.

TABLE I.—Comparison of Ecology/Ecological, Environment/Environmental, and Energy Courses by Total Numbers and Total Credits Between 1965-66 and 1975-76 for School/College at a Representative University

	Total Number of Courses				Total Number of Credits			
School/College	1965-66	1975-76	#	% Change	1965-66	1975-76	#	% Change
Agricultural and Life Sciences	3.33	16.51	+13.18	+396	9.00	40.78	+31.78	+353
Allied Health	—	0.50	+ 0.50	—	—	1.16	+ 1.16	—
Business	—	3.50	+ 3.50	—	—	10.50	+10.50	—
Education	—	3.00	+ 3.00	—	—	9.00	+ 9.00	—
Engineering	4.00	17.50	+13.40	+338	13.00	44.00	+31.00	+238
Family Resources and Consumer Science	—	1.50	+ 1.50	—	—	4.50	+ 4.50	—
Institute for Environmental Studies	—	27.07	+27.07	—	—	78.73	+78.73	—
Law	—	—	—	—	—	—	—	—
Letters and Science	15.66	50.56	+39.40	+223	36.00	138.55	_102.55	+285
Medicine	—	3.34	+ 3.34	—	—	9.00	+ 9.00	—
Nursing	—	—	—	—	—	—	—	—
Pharmacy	—	0.17	+ 0.17	—	—	0.50	+ 0.50	—
Interdisciplinary	—	0.50	+ 0.50	—	—	0.83	+ 0.83	—
Inter-College	—	0.33	+ 0.33	—	—	1.00	+ 1.00	—
Total	23.00	125.00	+102.00	+443	58.00	339.00	+281.00	+484

THE FUTURE OF ENVIRONMENTAL STUDIES

Are higher environmental studies a fad or a fixture? If anything assures their tenure, it is because they are really indigenous to the American university. The university world does not husband imports very well. Environmental studies are native to the campus.

In the first place, the environmental problem lends itself in part to technological solutions—gross scientific and engineering approaches. American universities are simply very good at big, massive engineering problems. Look what has happened just in the lifetime of adult Americans. We have lassoed the mountains and deserts of the West with sinews of concrete and steel. We have innundated simultaneously the forces of Fascism on two continents with tons of tanks and howitzers and war planes. We have in turn revitalized whole continents with massive shipments of technological know-how. And more recently we have gone to the moon, from hindsight almost as easily as a Sunday drive. We are superb at accepting big technological challenges and licking them. Universities are going to respond in exactly this same way to the environmental problem. It's a natural for campus know-how.

Second, there is an ethical, or moral, dimension to the environmental movement which is also very American. This country was born as a moral movement. We made the conquest of Trans-Appalachia a moral movement. Its real leader was not Daniel Boone but John Wesley. Our great-grandfathers were taken up by an intense moral movement in the 1830's and 40's—the abolition movement. We tend to forget the great clout that movement had as we carried it through to a very bloody resolution. At the turn of the century the prohibition movement swept this country, and again we carried it to a resolution; short-term, yes, but nonetheless a moral resolution. We didn't really start getting out of the Depression until we changed it from an economic problem to a moral movement. That was FDR's signal contribution. When he got up on that dark day in Washington and said, "We have nothing to fear but fear itself," he changed the whole gestalt, if you please, of the country. We made World War II a moral movement as well. Mr. Eisenhower didn't call his after-action report Campaign in Europe, he called it Crusade in Europe. More recently we made the Marshall Plan not just an economic device but a moral movement. So, in the sense that environmentalism requires changes in standards, requires value judgments, requires, as Leopold (1947) said, the emergence of an ecological conscience, it is a moral or ethical movement, with a high survival value on the American campus which has always had an evangelical tradition.

Three factors may operate to negate this prediction:

First, at the graduate level we could see a return to piecemeal researches and regimens that are the antithesis of the environmental perspective. University faculty structures, policies, and practices are not necessarily benign for cross-discipline programs (Levensky

1977). Junior faculty members particularly may find insufficient security in inter-college appointments with no tenure "home." It will take alert administration to foster the cross-fertilization of scholarship that may well be environmental education's greatest contribution to university enterprise.

Second, at the undergraduate level, where environmental studies are offered as broad education for responsible citizenship, they merit student enrollment and faculty support; but where they are billed as professional programs, they are a fraud on students who will never find entry positions as environmental generalists; consumer protectionism can and should catch up with the guilty colleges. Environmental studies "will be strong to the extent that they incorporate specialization," warns Nash (1977): "They will be weak if they face the dragon of environmental problem-solving with the blunted lance" of only the "well-rounded." The magnitude of the environmental problem "demands the specialist." Fortunately, students are beginning now to get practical career guidance from both the public and private employment sectors. For example, a current Environmental Protection Agency publication comes out loud and clear: "Specialize! That's the consistent recommendation of the experts to anyone contemplating a career in environmental protection" (Omahumdro 1977). This is not to say again, of course, that environmental studies are not a viable substitute for a non-professional liberal arts-and-science regimen.

Third, environmental studies could die of malnutrition. It is one of the anomalies of history that environmentalism came to the campus virtually simultaneously with a progressive decline in university wherewithall. Rarely has it enjoyed the fiscal support that could have been there if it had appeared even five years earlier. Nor have federal or foundation funds been forthcoming in anything approaching the need. It has only been through frugality that environmental studies have sustained themselves. A projected general decline in university enrollments or a freeze on government grants could threaten the continued development, if not the existence, of environmental studies. So could a public backlash against the tough resource management options that are bound to come out of campus laboratories and seminars. Fortunately, according to a recent national poll, "environmental protection has been transformed into a popular, institutionalized movement that shows little sign of abating, even during a period of economic stress" (National Association for Environmental Education 1975).

What is not beyond the realm of possibility in the future is a great environmental cataclysm, very real and very widely perceived, that will "energize Americans and all people in the manner of the Great Depression and World War II, and bring society crying to the campuses for help" (Nash 1977). We need a strong base of environmental studies in the universities in order to be prepared to respond effectively to any such calls.

The university certainly has as yet no magic formula for capsuling and administering an environmental perspective to assorted peoples and places. It increasingly recognizes the importance, however, of confronting the campus and its patron community with sets of resource management principles and values, and encouraging professors and laymen alike to face the broad environmental problems upon which the American public is being asked to render crucial judgments. Increasingly out of this flux have come integrated programs and techniques based on, and consistent with, a synthesis of new knowledge in the sciences, arts, and letters, and which may find their expression through public policies; private management decisions; actions of business, farmers, and labor; consumer behavior in the market; and voter behavior at the polls. In essence, we are coming to address ourselves to laying a basis for actions, to elucidating the choices in resource use and relating them to general values and social objectives, to instilling in people a desire for constructive change, and to providing practical guidelines characterized by integrated approaches. This is the changing role of the university in the new conservation, as American life and American learning proceed together toward what can yet be broader lands and fairer days.

The strategic continental objective is an open marketplace of ideas, with environmental educators of varying persuasions vying for attention, outlining varying options, and contributing to a mass facility with the democratic decision-making process. It is the making of sophisticated choices, the rendering of subtle value judgments, that is the essence of environmentalism today, whether the issue is weaponry, water, or whales. The prime task of environmental education is a good old American goal—to reinforce more freedom of choice. The citizen who wants to conserve must be given more chance to conserve—in the home, in the marketplace, at the ballotbox. Environmental educators will increasingly be put to the test of discovering and implementing viable options in an unemotional, objective, self-disciplined manner. If their expertise comes wrapped in superficiality, pretentiousness, over-emotion, or, even worse, intellectual dishonesty, they only add moral insult to environmental injury in a most unecological way.

Jordahl (1976) looks to more emphasis on (1) a basic understanding of the earth's resources, (2) a knowledge of their interrelationships, (3) identification of each problem and its root cause, and (4) options for corrective actions that attack the disease, not its symptoms.

Environmental studies have this over-riding responsibility—somehow to impart a sure recognition of the utter interdependency of every element in our interlocking systems of ecology, energy, and economics (Commoner 1976). There are no unilateral solutions; there are only uneasy choices. If we make the right ones, we may restore the circle of renewable life systems. If we do not, it will simply mean the human animal was not a species destined to survive. We may discuss food separately, or population, or poverty, or wildlife, or shelter, or energy. But where do they all come together, reacting on each other, enhancing hope, or undermining it? In environmental studies (Ward 1976).

The case studies that follow suggest a variety of ways and means by which the university is responding to the environmental imperative today. With few exceptions, the case histories are written not only with precision but with feeling. A striking number of contributors confessed that the exercise of writing their reports stimulated them to re-think both the philosophy underlying their programs and their operational goals. The resulting insights show through in such a way as to make such case studies unusually revealing.

One final caveat: By no means should it be assumed that what is represented here is all there is, either continent-wide or on a particular campus. Collectively, we believe the case studies included here are genuinely representative of college and university environmental enterprise today, but they constitute far from an encompassing catalog. At any one university, the program described herein is invariably only one aspect of that institution's reaction to the environmental era. Withall, these case histories are nonetheless a clear indication of the state of the art in higher environmental studies programs, AD 1978.

(Editors' Note: All references are listed at the conclusion of the Epilogue, p. 493.)

SYSTEMIC APPROACH TO HIGHER EDUCATION THROUGH THE ENVIRONMENT: UNIVERSITY OF WISCONSIN-GREEN BAY

by Forrest H. Armstrong and Charles F. Matter*

If there is a one-and-only holistic environmental studies university in the United States, it is probably the University of Wisconsin-Green Bay. UWGB's academic topographic map is not that of the conventional campus. In place of departments are "concentrations" of professors oriented to particular public problems. In lieu of schools and colleges are "conceptual entities." Tailored programs replace disciplinary majors. In place of multiple modes and missions is a single university-wide theme, "people and the environment." Such a total departure from higher education norms could probably only have happened in a state long attuned to experimentation, under a gambling chancellor, at a time when the four-year institution was being created from scratch. The choice of the environmental theme in 1966 was largely fortuitous, but it has vaulted UWGB to worldwide attention in ten short years. The authors are frank to admit it is still too early really to assess the UWGB organization and operation, but they believe the strengths of the model are "many and vital."

The University of Wisconsin-Green Bay is widely known as the university at which a unifying theme--"people and the environment"--helps students and faculty alike take a holistic view of the quality of human life. In the early Seventies, when the public became generally aware of matters such as environmental degradation, the institution became known as "Ecology U." Though understandable, the appellation is also unfortunate, since it could mislead people into thinking that the institution's focus is on the bio-physical world alone--"environmental" in the restricted sense of the term. In fact, quite the opposite is true; the institution transcends environmental sciences to focus on what the prologue to this volume terms environmental studies. The special genius of the institution is not that it focuses narrowly and exclusively

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on the natural environment, but that it has devised a means whereby the systemic thinking which has shown us the importance of protecting the natural environment can be extended across the full range of human concerns which affect the quality of our life.

UWGB is a young institution. It was chartered in 1965 as one of two new publicly supported universities which would join doctoral campuses at Madison and Milwaukee to form the University of Wisconsin System. The new campus was charged to produce an educational approach which would be particularly effective in addressing the concerns of the future. In 1966, after working with various advisory groups from the community, region, and profession, Chancellor Edward W. Weidner proposed an Academic Plan which sought to address pressing social concerns through educational reforms.

Reflecting lessons learned all too well from the turmoil through which our campuses were going at that time, the Academic Plan posits that the university ought be a part of, not apart from, society, and that students ought be stimulated to develop a sense of social commitment which would motivate them to put their knowledge to work for social as well as individual ends. Moreover, students ought be assisted in developing the capacity to go beyond simply amassing knowledge to being able to apply it in real-world situations. The emphasis on application is important for two reasons. First, making education immediately relevant can enhance the student's motivation. Second, as the environmental crisis itself has shown, our problems often arise not so much because we have failed to amass relevant knowledge about the effect of our actions but because of our inability to apply that knowledge effectively (a failure embedded in part in an inappropriate set of values).

Both concerns--motivation and application--suggest that the focus of a student's education ought be centered on problems, a model borrowed from the land grant university. A problem-centered education can be immediately relevant to students whether they are interested in acquiring knowledge for its own sake or whether they are of a more pragmatic bent. And it is an ideal format for dealing explicitly with the application of knowledge in a context similar to life itself. Students who apply themselves to pressing human problems, though, will seldom be able to do so within the confines of a single discipline; problems are seldom neatly bounded, much less according to the traditional divisions of knowledge. Instead, persons working in a problem-solving mode will typically need to be able to draw upon insights gained from diverse bodies of knowledge and, through systemic thinking, to see the relationship between such insights and the problem at hand.

Thus, form following function, the central building blocks of the university, both intellectual and bureaucratic, are not disciplines but interdisciplinary problem-centered units called concentrations which serve as majors for students and as departments for faculty. These concentrations, presently ten in number, seek to represent enduring problems of pressing concern to all people such as environmental degradation and control; social change and development; population dynamics; human growth, development, and adaptation; cultural preservation and transmission; human identity; and urban life.

Disciplines are an integral part of UWGB's academic program, but unlike the problem-focused concentrations the disciplines are not free-standing budgetary units. Instead, they exist to serve and support the problem-focused units and should contribute to a variety of programs across the institution. Faculty are commonly members of both a problem-focused concentration and a disciplinary unit, though only the concentration has the traditional departmental powers of personnel and budget. Thus it is that psychologists contribute to the curricula of seven of the ten different concentrations, biologists to six, and historians to six. Students may major in an interdisciplinary unit by taking an approved program consisting of not fewer than 30 semester credits of interdisciplinary work at the junior-senior level. Or, they may argue that the best way to get at a problem is to combine work in a discipline with an interdisciplinary problem focus, to get at problems of urban life through an emphasis in sociology. This option, called a co-major, requires that the student take a program of at least 36 upper division credits spread across the discipline and the interdisciplinary field.

One commonly expressed concern about the traditional disciplinary division of knowledge has been that it has tended to become overly fragmented and specialized, with a two-fold negative effect: first, that persons working in such fields would come more and more to emphasize artificial rather than real-world situations and second, that they would, like the blind man touching the elephant, develop a sense of alienation and isolation by being bereft of the opportunity to understand the whole as well as the part. An interdisciplinary, problem-focused intellectual organization has inherent advantages in addressing such concerns, since its systems approach emphasizes the interrelatedness of things and a holistic vision. A problem-focused organization also fragments knowledge, though, and may include an inherent bias toward development on the periphery of the problem, ever expanding its linkages, rather than narrowing into its center. Developed fully, the intellectual imperative behind problem-focused education may well impel each problem-centered unit toward becoming a university within a university.

What is needed is a centering mechanism, something to counteract the centrifugal forces at work in the modern university. To provide such a centering mechanism, UWGB's Academic Plan establishes two crucial elements: a university-wide theme and a core program in applied liberal education common to all students. The theme helps guide the actions of faculty and students alike, setting parameters within which to focus intellectual development; the core program serves not only to emphasize essential value-related themes and concepts, but also serves as a reference point through which they are constantly reminded of the relationships between the problem on which they have chosen to work and the other problems which they also face in life.

Environmental Theme

The existence of an all-encompassing theme is a particularly important centering device; it encompasses all fields of knowledge, helping guide not only the developments within areas of emphasis but also demonstrating the relationships among diverse fields. Thus it emphasizes the interrelatedness of problems and ideas—the systems approach, which is at the heart of the university's intellectual thrust. The mere fact that the theme exists may actually be more significant than the precise theme chosen. That UWGB chose to examine the multiple relationships we enjoy with our various environments may have been a remarkable prescient choice in 1966, given the upsurge in interest in environmental matters at the end of the decade, but it is by no means the only excellent theme which could have been chosen; other institutions might profitably focus their efforts through a different unifying theme.

The Environmental Education Act of 1970 offers a definition of "environment" which fits current connotations:

> The term "environmental education" is...the educational process dealing with man's relationship with his natural and man-made surroundings, and includes the relationship of population, pollution, resource allocation and depletion, conservation, transportation, technology and urban and rural planning to the total human environment.

Here, the emphasis is on tangible aspects of the bio-physical environment which we can taste, sense and feel. The term "total human environment" implies there is something more, but just what that might be is neither specified nor emphasized. Perhaps it is only recently that the term "environment" has come to connote merely the natural environment, for according to Webster, the term means "the aggregate of all the external conditions and influences affecting the life and development of an organism, etc., human behavior, society, etc." More simply, Buckminster Fuller, speaking at an early UWGB commencement, defined environment as "the not me." If his definition be overly general, it is nonetheless useful to remind us that intangible things—ideas, abstractions, tradition, the intellectual baggage we all carry—are every bit as much a part of our environment as the tangible, visible part, though they may be somewhat less easily seen. Viewed in this way, one might relate environment to "context," a setting within which one lives and with which one has a set of reciprocal relationships, by which one is shaped and which one shapes in turn. The bio-physical environment is very much a part of the context in which we live; it provides both opportunities and constraints which affect what we can do and become. Similarly, the socio-cultural environment varies across peoples and has its own formative impact upon us.

Theme Colleges

Any theme must be quite broad and general if it is to pertain to all fields of knowledge; to be most useful, though, some greater elaboration and specificity are needed. Thus, the Academic Plan established four conceptual entities called *theme colleges within* which greater elaboration of the theme could take place and which would accommodate idiosyncratic emphases and nuances emanating from different domains of knowledge. The theme colleges are conceptual, not administrative entities; for bureaucratic purposes all of the faculty, organized through the interdisciplinary, problem-focused concentrations, are a part of a single structure with a single Dean. This administrative model shares more with the small liberal arts institution than the typical state university, but grows naturally from the intellectual thrust of the institution and reveals a good deal about it.

College of Environmental Sciences

As would be expected by its title, the perspective of this theme college on the bio-physical context of human action makes it central to UWGB's systemic approach to knowledge. Programs within this college are designed (1) to probe the concept of the ecosystem and provide an understanding of the systems by which materials and energy are exchanged between living organisms and their physical and chemical environments, (2) to provide an understanding of the myriad ways our use of natural resources affects the functioning of the ecosystem, and (3) to provide an understanding of the alterations of the ecosystem due to our addition of contaminants to air, water, and soil. The program is structured in such a way as to allow students to bring these understandings to bear upon matters of scientific theory and technology, resource management and administration, and scientific communication and interpretation.

College of Human Biology

This college focuses on the processes by which our biological heritage and nature affect the human experience. People are viewed as dynamic organisms responding to internal and external demands through adaptation and development. Since the demands we face arise from social sources as well as chemical and physical ones, behavioral processes are stressed as well as those of nutrition and physiological adaptability. Similarly, while some of these demands are primarily expressed in terms of the individual, others appear at the level of the group, so the programs of this college examine the dynamics of populations along with the growth, development and adaptation of the individual. In short, as this college attends especially to the biological dimensions of the human response to our internal and external environments, it could be viewed to span between the bio-physical concerns of the College of Environmental Sciences and the social-cultural focus of the following two colleges.

College of Community Sciences

As social animals, many of the significant events in our environment arise from interaction with others. This unit examines the nature of human social interactions and the impact of such interactions on individual, group, and society as well as on the natural and cultural environments. Reflecting the conditions of modern life, it examines the problems and potentials inherent in living in relatively close proximity to one's fellows. It analyzes past and present forms of social organization in cultural context and considers the relationship between culture and society. In considering alternative visions of the possible, desirable, and appropriate relationships between individuals and the collectivity, it deal directly with the nature of and possibility for achieving community. Reflecting the major forces at work in contemporary society, the programs in this college focus especially on the urban experience, the regional setting, and the processes of social change and development.

College of Creative Communication

A person is not only a biological organism and a social creature but also a seeker after aesthetic, intellectual, and ethical fulfillment. Humans are, in short, animals with the distinctive prerogative of cultivating a second nature--the realm of culture. The college addresses the questions of aesthetics and values integral to this cultural realm and seeks to provide some understanding of ways in which human traditions are perceived and transmitted. Thus, it is also involved in interpreting the meaning and significance of our biological and social environments. In these ways, it explores the dynamics through which culture enriches the quality of our experience.

Core Program

The thrust toward integration of ideas suggests the need for a core curriculum; the special importance that moral and ethical questions assume at this university suggests that the core curriculum ought address the relationship between transcendent value questions and our environmental concerns. To address such matters, the university offers the University Seminars Program, a vertically integrated 18-credit package, which is required of all students and which may be the most important single program at the institution.

The core program is composed of three parts, each of which is broadly interdisciplinary. The six-credit Freshman sub-program, "Crisis in Belief and Ecology," is designed to help students understand that life is shaped in part by the values we hold and that different value systems may suggest alternative approaches to making choices and taking actions upon essential human issues. It seeks to do so, in part, by introducing them to a variety of ethical and environmental problems and to a variety of perspectives on defining what constitutes an "appropriate" set of responses to such problems. In seeking to develop students' awareness that their values affect their various environments, the program deals in broad interdisciplinary themes which can be addressed by faculty from a variety of disciplinary backgrounds. Students are required to take four seven-week modules over the course of the year from among such topics as "Technology and Human Values," "Freedom and Social Control," "Attitudes and Values in the Natural Environment," and "Resource Utilization and the American Character."

In the nine-credit Intermediate sub-program, students and faculty focus upon the analysis of a specific value-related problem or set of problems from a cross-cultural perspective. Through this thematically-integrated sequence of courses students will:

a) develop analytical skills appropriate to proposed experiential learning in at least one off-campus project;

b) participate in a project aimed at developing a better understanding of the problem in the local or regional cultural context;

c) participate in an other culture experience aimed at developing a better understanding of the same problem in cultural settings different from the local or regional context;

d) make cross-cultural comparisons and/or analytical extrapolations derived from the experiential learning.

Ideally students will gain perspective on their own culture by traveling to conduct field work in a contrasting culture during the January Interim Period of the 4-1-4 calendar. On-campus opportunities are provided for persons who cannot afford to travel to another culture. The Intermediate program builds on the Freshman program in challenging traditional problem formulations and stimulating the imaginative pursuit of models for change.

Intermediate packages this year include: "Black and White Americans: How We View Ourselves and Each Other," "Cultural Conflict in Canada," "Individual and Social Consequences of Sex Roles," and "Artists as Analysts, Prophets, and Preachers."

The three-credit Senior sub-program is the culmination of the student's interdisciplinary liberal education at UWGB. The program consists of advanced interdisciplinary seminars designed to enlarge the student's perspective, analytical ability, and interest in the enduring problems of self and society as they relate to contemporary ecological, cultural, ethical, scientific and political concerns. The program emphasizes reflection and conceptualization. The student is encouraged to extend knowledge gained in earlier courses to the broad fundamental concepts and issues that comprise the basic social and intellectual concerns of our time. These issues range from the problem of preserving individual dignity to the political, social, environmental, aesthetic, and ethical dimensions of contemporary life. Considerable emphasis is given to exploring alternative concepts of freedom, progress, imagination, myth, ecological systems, and intellectual and educational paradigms which relate to a multitude of issues which will affect students in their future years. Sample themes include "The Scientist and Social Responsibility," "The Problem of Progress," and "Culture, Lifestyle, and Science in a No-Growth World."

Problem Foci

With an entire university dedicated to problem-focused education, the number of problems dealt with is large indeed. Each of the concentrations is necessarily construed in reasonably broad terms, but most have specified a range of concrete problems which they address. Thus, in the environmental sciences the problems can become as specific as development of organic alternative energy sources, a subset of an emphasis on resources recovery which is dealt with as one aspect of the waste management problem. Typically, domains of knowledge less given to taxonomy have somewhat greater difficulty in defining problems which they find meaningful at the same level of specificity as the environmental sciences.

Several macroscopic problems find expression broadly throughout the curriculum, influencing the various programs in different ways. It is not surprising that essentially all units are concerned with matters of population, though the subject is dealt with differently in the Population Dynamics Concentration than it is in Urban Analysis. Similarly, as many as half the units are found to deal with some aspect of such broad gauge problems as food supply, resource depletion and human relations.

At a reasonably abstract level of generalization, nine macroscopic problem categories can be identified:

1. The Human Bio-Physical and Built Environment
2. Social Institutions, Values, and Community Conflict
3. Human Health Status
4. The Role of Arts in Society
5. Natural Resources
6. Economic Well Being
7. Social Relations and Community Life
8. Population Growth, Age Distribution, Migration, and Patterns of Settlement
9. Provision of Public Services

In turn, each problem category yields a number of subsets. Thus the provision of public services can be broken down into the various services being provided--housing, transportation, health care--each of which can be treated by addressing the adequacy of the present mode of delivery, proposing new criteria of evaluation which reflect the awareness of the role the particular service plays in context, and then proposing new ways to provide the service more effectively.

The environmental design program provides an excellent example of how a problem-focused unit can operate. It is staffed by persons whose backgrounds are in engineering, graphics, architecture, planning, and psychology. Its curriculum is based on the studio model in which students pursue a core program of workshops which they alloy with a wide variety of courses augmenting the studio experience to help them develop a field of specialization. The workshops are organized along a graded scale, beginning with the individual and progressing through ever larger spheres. Progressively, the students are confronted with design problems they are to solve, moving from, perhaps, the design of a chair, to the design of an airport waiting room, to the design of the airport itself, and finally to the design of the region in which the airport is located.

At each stage in the design process, the student is responsible for addressing the full range of issues which the design project makes relevant and the full range of criteria upon which it should be evaluated, including the client's preferences. Thus in designing the chair it is necessary to pursue aspects of anatomy, ergonomics, and the strength of materials as well as aesthetics and economics. At the waiting room level additional factors such as human territorial behavior, the sound absorption properties of materials, and cultural factors in crowding become involved. Commonly the choice of design projects is not arbitrary but reflects the needs of actual clients in the community, ranging from the City Council to the regional health planning council or the local arm of the Rand Corporation.

Among the many exemplary features of the environmental design program is that each stage of the student's development is an active one, with a tangible product. The final exam for the introductory course is to design and execute a personal shelter which will protect the occupant through a Wisconsin winter night at a materials cost not to exceed $3; the evaluation comes about when all members of the class, instructors included, spend a December night in their shelters on the campus golf course. An advanced class designed and implemented a revitalization project for a Green Bay neighborhood, including initiating an ongoing neighborhood organization, executing a program for physical and social revitalization and successfully achieving federal funding for the project. Currently, students have just begun public advocacy of their plan to revitalize a portion of Green Bay's central business district through taking advantage of tax increment financing. Besides engendering a strong sense of motivation and commitment on the part of the students involved, these projects are outstanding examples of the extent to which students can make lasting social contributions while pursuing their studies.

A good illustration of the application of a problem-focused approach in the arts is the Aesthetic Awareness Program within the Communication-Action Concentration. This program views the aesthetic experience as a common ground both within the arts and between the artistic and other spheres of life. The concern then is with understanding and strengthening the processes that enable an aesthetic response to the human environment—natural, created, and built.

The program involves faculty trained in literature, music, photography, psychology, theater, and visual arts who work together both to teach courses in the program and to direct its other aspects such as offering workshops for teachers. Across the range of the six core courses of the program, the students (a) explore the foundations of the aesthetic experience, (b) engage in creative and other experiences designed to heighten and enrich their aesthetic experience, (c) examine the cognitive, perceptual and physiological aspects of the psychological processes involved, (d) consider the implications for and from the artist, (e) become familiar with systems for evaluating aesthetic qualities of works on events, and (f) participate in a senior seminar that enables them to bring this knowledge to bear on an issue of personal significance. Students combine their work in this program with other suggested courses as preparation for a number of ambitions spanning from a teaching minor in Aesthetic Education through acquiring a broadened context for their work as artists to enriching the quality of their lives as non-artists.

Assessment

The best measure of the institution's success is an output measure--its impact on society. This impact will take place primarily through the lifelong activities of its graduates; since the first students to complete a four-year undergraduate program at UWGB graduated only four years ago, the data are yet inadequate to support such an assessment. Secondarily, the institution's impact on society could be indirect, through its influence on other educational institutions. It appears that the ideas upon which UWGB is based may have a considerable impact, especially abroad, through strong interest shown by the Center for Educational Research and Innovation of the UN's Organization for Economic Cooperation and Development. UWGB has just completed a major curriculum development project for Bu Ali Sina University in Iran; UWGB is one of only five universities in this country chosen for study by the Swedish ministry of education pursuant to its reform of that country's educational system; and the Green Bay approach has influenced the development of United Nations University on whose Council Chancellor Weidner serves. Here, too, the actual success of the young institution's ideas (compared to their potential for success) remains largely untested.

Student subjective data from the class of 1977 indicate that some of the key inputs to a UWGB education have been well received by students. The strengths inherent in a problem-focused education are particularly evident to students, as are the contributions which interdisciplinarity and a systems approach can make. The core program is perhaps the most controversial feature among students, with a strongly bi-modal distribution of opinion as to its desirability and effectiveness,

Matters of concern among faculty have been (1) the existence of a common focus and the precise focus chosen, (2) the extent to which all fields of knowledge can participate in a problem-focused mode of education, (3) the "risk factor" associated with the unique demands the institution places upon faculty, (4) the core program, and (5) the relationship of the disciplines to the institution. The fact that the conditions for American higher education changed from expansion and euphoria to retrenchment and pessimism just as the institution was beginning operation clearly occasioned or intensified some of these concerns.

The environmental theme is sometimes misconstrued as being narrowly focused on the bio-physical environment alone, particularly by some persons in our immediate region, including high school guidance counselors, parents, and prospective students. This sort of misperception has given rise to the feeling on the part of some faculty, commonly from areas which would not be included in "environmental" narrowly defined, that the existence of a theme, this one or otherwise, is unacceptably restrictive, since it devalues their intellectual contribution or precludes it entirely. A more troublesome assertion is that the ability to relate well to a problem-focused curriculum is field-dependent, easy for the social sciences but difficult to impossible for the humanities. Collectively the humanities (and some of the fine arts) might feel that problems are intended to reflect a "here and now" bias which excludes the essence of what they have to contribute to the intellectual process. Persons from the humanities disciplines have been more successful individually than collectively in adapting to problem-focused education.

Intellectual adaptations of this sort are commonly required of faculty at UWGB, who are themselves after all products of an educational system which is not organized along interdisciplinary, problem-focused lines. For just this reason, the institution provides strong stimulation and support for continued intellectual development for faculty who wish to pursue it, but it is a development which emphasizes breadth and interrelationships with heretofore unexplored ideas rather than the specialization encouraged by disciplinary boundaries. Both the exciting intellectual opportunities and the unique institutional requisites for faculty (such as the extensive development of interdisciplinary courses and curricula not found elsewhere) necessarily take place to some extent at the expense of activities which are conventionally viewed as being "worth" more in the profession nationally; hence the concern for the opportunity cost one incurs when joining UWGB. To the extent that applied research is "worth" less than basic research, to the extent that opportunities to publish interdisciplinary research in refereed journals are less extensive than for disciplinary research, the faculty member may have to choose between the value system operative within the institution and that in the profession at large. Concern over the risk factor especially has been exacerbated by retrenchment and the accompanying loss of mobility suffered by faculty in the Seventies.

Recently changes have taken place in the relative balance among various parts of the curriculum. Originally, the emphasis was on the interdisciplinary almost to the exclusion of the disciplinary (students could major only in an interdisciplinary field) and upon a strong required core program of liberal education, consisting of 24 credits. In 1974 the core program was reduced to the 18-credit model described above, partially to strengthen the vertical integration between levels and partially to reduce the number of "irrelevant" credits required of students. Currently discussions are underway which propose decentralizing the core program and integrating it with a destribution requirement. Last spring, the Faculty Senate approved a proposal which will allow students to claim a disciplinary major, not by reducing the number of interdisciplinary credits previously required for a co-major but by increasing the number of disciplinary credits. This action brought into sharp focus the difficulty of relationships between the disciplines and the interdisciplinary units. The number of courses cannot change, since the faculty is not growing, yet the disciplinary major proposal will emphasize offering of additional disciplinary courses. The disciplines, though, are not budgeted units; control of staffing decisions, recruitment, and the like resides with the interdisciplinary units. Furthermore, since the disciplines' role has been one of service to the interdisciplinary programs, faculty in the disciplines have been recruited less for coverage of the discipline than for contribution to interdisciplinary units; as a result, some disciplines are understaffed and others are relatively skewed in their specializations within the discipline.

Summary

The University of Wisconsin-Green Bay is a young, innovative institution at which an environmental theme encompassing all fields of knowledge promotes a holistic approach to maintaining and enhancing the quality of life. In the terms of the Prologue to this volume, it is an "environmental studies" university--embracing both environmental sciences and environmental education in a broadly interdisciplinary, problem-focused curriculum. It stresses conscience and commitment in a comprehensive program which emphasizes the unity of knowledge.

On balance, we believe that the strengths of the UWGB intellectual model are many and vital, and that they fully warrant continued efforts to implement it. We believe that it compares not unfavorably with traditional higher education, even though the one is fully mature and the other but in its infancy. It appears that the evolution of thinking worldwide is toward the systems approach, in which the interdisciplinary search for relationships is central and essential. Perhaps the particularly strong gains our students perceive in their ability to think critically can be attributed to this approach, just as their perception of the similarly strong advances they are making in the humanities may be attributable to the core program's effectiveness (if not its popularity). We think it particularly important that the UWGB model will bear fruits regardless of the career choices our students make. Some build upon their undergraduate experience here to become creators of new knowledge; others put their knowledge to use directly in a profession. But all, regardless of occupation, can draw upon the insights and approaches to problem solving gained as undergraduates as they go about their daily lives as private citizens.

If there were one change we might make to facilitate implementation of the program, it would be to be able to serve a somewhat more homogeneous constituency than we must, for given our existence as a publicly supported institution, there will always be persons who come because of our location rather than our program. The need to serve both our natural and our intellectual constituencies represents perhaps the greatest hurdle of all.

NATURAL AND ENVIRONMENTAL RESOURCE PROGRAMS: UNIVERSITY OF WISCONSIN EXTENSION AS A CASE STUDY IN ENVIRONMENTAL EDUCATION

by Marvin T. Beatty*

University of Wisconsin Extension is unique in that it (a) represents a merger of General Extension, Cooperative Extension, State Radio-TV, and the State Geological Survey; (b) serves as the outreach arm of all the state's institutions of public higher education--the University of Wisconsin System; and (c) has organic ties with the State Board of Soil and Water Conservation Districts. Linking soil and seminar in the tradition of "the Wisconsin Idea," the Extension apparatus in Wisconsin is beautifully postured to carry out a multi-disciplinary, multi-media, multi-publics, problem-solving approach to environmental adult education of a scope and calibre probably unduplicated elsewhere in the country. Dr. Beatty, the Statewide Chairman for Natural and Environmental Resource Extension Programs from 1972-77, epitomizes the Wisconsin tie between campus and constituencies in that he is at once Professor of Soil Science in the US-Madison College of Agricultural and Life Sciences and Program Chairman for Natural and Environmental Resources in UW-Extension. With a background as a soil and land use specialist, he has worked closely with county agents and other educators around the state. His paper summarizes a complete report available as indicated.

Introduction

Effective outreach and extension of the knowledge base of universities in environmental matters to the many kinds of students in our complex society is a major challenge in environmental education. If we accept the proposition that, in the long term, effective action to protect the environment requires not only willingness to act, but also a basic understanding of ecological and other scientific principles, then it is clear that universities have indeed a formidable challenge.

In the rapid pace of modern adult life most programs of continued learning for adults must be formulated and delivered in terms of major immediate problems, interests of the students concerned, and with students participating in the planning of the programs. This means that teaching

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programs must have obvious relevance and appeal. The material and manner of presentation must also be sound, authoritative and adapted to the needs of the audience (students), or they will simply not continue to attend a program and most certainly not reappear for future programs, Lest this analysis seem overly pessimistic, it should be pointed out clearly and forcefully that good, interesting, relevant and authoritative programs dealing with the environment can attract large and enthusiastic audiences who often are willing to put what they learn into individual or collective practice very quickly. Stated differently, environmental education programs can either contribute to the problem of excess communication in our society or to the solution of extremely basic societal problems relating to the environment. There is little margin for error.

Program Organization and Scope

The natural resource and environmental outreach programs at UW-Extension described here are developed within a framework of an integrated university-wide outreach system. This integrated system has resulted from successive mergers of separate, smaller extension systems during the past decade. The program staff includes over 50 specialized faculty and academic staff who are located on various of the four-year campuses and two-year centers of the University of Wisconsin System. Long-term programmatic and fiscal relationships are maintained with all counties in the state to support a substantial (about 350) community outreach faculty (county agents). Many of these faculty participate in the development, delivery and evaluation of the environmental education programs. Long-term relationships are also maintained with federal agencies such as the U. S. Department of Agriculture Extension Service (Cooperative Extension) and the U. S. Department of the Interior Geological Survey and Bureau of Mines, as well as with state agencies such as the Department of Natural Resources and the Board of Soil and Water Conservation Districts. Many contracts, short-term projects and similar programs are always underway in cooperation with various public and private entities.

Objectives

The objective of natural resource and environmental programs in UW-Extension is summarized as: "To help individuals, groups of citizens and organizations improve the management, use and protection of natural resources, including energy resources, and improve the quality of their environment. Specifically, key natural resources such as rocks, minerals, soil, water, climate, and topography are inventoried and analyzed; educational programs are conducted with people on management of wastes, control of pollution, energy conservation, improvement of wildlife habitat, lake, stream, mineral, and forest resource protection and management, land use problems and concerns, and similar environmental problems and issues. Local, regional, state and national aspects of these topics are included."

Major Student Groups and Programs

An effective program of education on environmental topics, problems and issues must reach and change the attitudes and behavior of many groups in society. The natural resource and environmental programs of UW-Extension attempt to do this. Programs for 1975 have been described by Ch[illegible] (1976).

Professional resource managers are an important group for turning environmental plans and programs into action. If they do not understand the principles and optimum practices of resource management, constructive changes are greatly impeded. UW-Extension provides both concentrated and continuing education, along with important sources of data, for many professional resource managers.

Limnologists, aquatic biologists and others interested in lake systems and their management have participated in intensive short courses and workshops on the rehabilitation and management of inland lakes. Certified soil testers who evaluate land for on-site disposal of household sewage get intensive field and classroom exposure to the principles and practices they must understand and use.

Semiannually a class of about 20 planners from the Bureau of Land Management, often with staff members from other public agencies as well, participate in an intensive two-week course "An Introduction to Planning." The session gives the participants, most of whom come from a specialized disciplinary background, the broad and integrated understanding needed to lead effective programs of planning for competing multiple uses of the public lands of the United States.

Governments

Nearly every environmental program requires action by governments, often at several levels. A major component of UW-Extension's programs in natural resources and the environment deals with members of government as "students." Elected and appointed government officials find most new environmental programs baffling, if not frustrating. This is partly because the programs are new. It is also because as a nation we are changing our policies for dealing with natural resources. As Runge (personal communication, 1976) has observed, the U. S. has generally reserved the right to deal with water resources to the federal and state governments alone, whereas the rights to deal with land resources have been delegated to private individuals and the lowest levels of local government. We are now trying to operate environmental programs dealing with water and land resources in an integrated manner which, to be effective, must have the active and informed participation of governments at local levels. Local governments, and to some extent state government, are ill-equipped by experience and understaffed to deal with these major new programs and the changing concepts involved. Community faculty help local officials deal with the complex and lengthy regulations, the enormous delays in funding and implementing some federal environmental programs, and the uncertainties of decision-making in these new ventures. Subject matter areas receiving attention in this process of taking university resources to the people include residuals management (solid wastes, used oil, sewage, etc.), municipal waste treatment, water and air pollution abatement, floodplain and shoreland zoning and management, and non point source pollution abatement.

Industries and Businesses

Many industries have special needs for natural resource information. Among these are the construction industry, the well drilling and engineering firms, the forest industry, utilities, and land development firms and subdividers. The Wisconsin Geological and Natural History Survey, one of the units of Extension's Natural and Environmental Resource Programs, is an abundant and much-used source of information on earth resources including climate, geology, soil, topography and water. The Survey has many published maps and reports, both of its own studies and those of the U. S. Geological Survey. These are extensively purchased and widely used.

Forest industries receive technology transfer assistance from UW-Extension in several ways. Lumber grading short courses are held at least twice each year for the sawmill industry; the maple sugar-producing industry gets information through a one-week series of intensive meetings on modern methods of maple syrup production and processing. Utilities work closely with Extension faculty in Landscape Architecture who have developed a functional framework for evaluating the environmental impacts of energy transmission corridors across the landscape.

Voters

Public policy education on environmental policies and issues in an important component of an overall environmental education program. Extension has engaged in public policy education on several controversial problems and issues over the years. One which is of major current interest and importance is the use-value taxation of agricultural and undeveloped land. We mounted an intensive public policy education program statewide immediately after legislation authorizing a statewide referendum on the possibility of modifying the constitution to permit this type of taxation passed the legislature. The constitution was subsequently amended, and various legislative proposals have been put forward and debated. Extension continues to carry on a program dealing with the various alternatives and their probable consequences for various sectors of society as this issue continues to be debated and discussed in the legislature and throughout the state. As a result of this kind of education, voters are able to make more informed choices when they go to the polls and to advise their legislators on this question. Frequently public interest groups such as the League of Women Voters and special interest groups such as farm, environmental, and conservation organizations collaborate in this type of education.

Land and Land Owners

Extension works with homeowners, owners of suburban and exurban parcels, forested areas, farms and various commercial and industrial establishments. Some of the principal programs relating to environmental education include: for homeowners -- information on energy conservation and development of grounds and ground covers; for prospective homeowners -- site selection which minimizes problems of flooding, wet basement inoperable septic tank systems, excessive erosion and loss of valuable plant species. Absentee landowners are interested in property rights and governmental services on land they own but do not occupy at all times, as well as in development and management of the land for forests, wildlife, and various wild and exotic plants. Groups of landowners, with local governments participating, are helped through educational programs on land use controls for protection of environmental areas, prime agricultural land and the development of an orderly overall pattern of land use in a community. Farmers are assisted with farm animal waste management and erosion control programs via soil and water conservation districts. A recent development includes assistance to counties wishing to develop county-funded cost sharing programs for landowners who construct environmental improvements such as streambank protection and improvement, gulley control, animal waste management facilities and similar environmental improvement practices.

Assisting property owners around inland lakes with the formation and development of inland lake protection districts is a major new education program for UW-Extension. These districts were authorized by a 1974 Wisconsin law. Intensive activity by two statewide specialists and many county agents has resulted in widespread understanding of this law and its possibilities, subsequent creation of over 60 inland lake protection districts, and intensive annual training sessions for the officers of these districts as they begin to give leadership to new special-purpose units of local governments.

Adult Environmental Education

Individual adult education -- continued learning by adults for their own edification -- is a phenomenon of growing importance throughout the nation. Environmental education programs, in the words of one student, "fill a real niche for those of us who don't give a hoot for credits but are taking the courses for the sake of learning." From 1972 through 1975 there was a fourfold increase in the number of programs offered by the two departments which carry out this kind of outreach education in the Natural and Environmental Resources program area. Nearly all were filled to capacity. Topics have included identification and use of wild plants in Wisconsin for food, excursions to major wildlife areas to identify and observe various animal species, driving tours in various areas to analyze and get to know the plant communities, geology and landforms along scenic roads, and cross-country skiing and backpacking expeditions to study the flora and fauna of selected areas.

Independent study courses in biology, geology, forestry and other environmental areas help persons who are unable to participate in the group efforts just described.

For the last five years a radio program, "Conservation Almanac," has provided listeners to the state radio network with a continuing source of information on what's new, relevant and interesting in the environmental area. All of these programs provide a means of getting people interested and active in the environment. Participants gain new insights and a fuller appreciation of the complexity and balance of natural systems.

Teachers and Youth

Many adults carry with them environmental concepts and attitudes they learned as youths, often from teachers. Extension's environmental education programs for teachers and youth include a series of intensive, week-long credit workshops and other series of shorter, weekend workshops for primary and secondary teachers. Extension's Environmental Resources Center in Milwaukee County has worked closely with about 100 teachers per year, and they in turn use the information in teaching about 30,000 students annually. Several of the workshops for teachers are carried out in cooperation with the Wisconsin Department of Natural Resources. Kiwanis Clubs and Soil and Water Conservation Districts support teacher participation through scholarships.

A major element of Extension's programming with youth is the School of the Air radio program, "Wonderful World of Nature," which is broadcast about 30 times annually over the state radio network to about 55,000 fifth through ninth graders and their teachers. Youth programs, often through 4-H clubs, on forests, land use, wild flowers, song birds, farm game, geology, resource conservation, water, and similar topics provide opportunities for youth to get directly involved in their own learning experiences under the guidance of trained volunteer leaders, using materials prepared by UW-Extension. In addition to this formal project work, many other 4-H youth groups gain some understanding of the environment through participation in programs at outdoor camps maintained by UW-Extension or by counties at various locations throughout the state.

Summary and Conclusions

The diverse but integrated set of environmental programs just described had been growing and are generally considered to be successful and useful. The integrated approach of working simultaneously with a wide range of audiences (students) is notably more efficient and effective than having several smaller extension units working separately with only one or at most a few client groups or students. While substantial progress has been made, the needs and demands for the kinds of environmental education described in this case study greatly exceed the educational and fiscal resources available to provide it.

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THE MARYLAND COOPERATIVE EXTENSION SERVICE AND ENVIRONMENTAL EDUCATION: UNIVERSITY OF MARYLAND

by Marvin J. Bennof and David G. Pitt*

The Cooperative Extension Service, commonly known in some states as "ag extension," is often described as one of the oldest, largest, and most fully developed effective adult education activities in the United States. In essence, the CES is a partnership undertaking between each state land-grant college of agriculture and the U. S. Department of Agriculture, in cooperation with local governments and local people. CES is epitomized by the "ag agent" in each county seat, he being at once a university staff member, a federal civil servant, and a county employee. In agriculture, the traditional mission of the CES has been to carry out to farmers the fruits of agricultural research, and to bring back to the campus new researchable problems, with the main focus on improving and increasing agricultural production, and hence on lifting farm income and living standards. Prior to the dawning of the environmental era in the 1960's, this emphasis naturally led the CES at times to encourage land management practices that presently would be considered unacceptable in terms of their impact on the environment. CES has always been sensitive to conservation needs in forestry and farming. Food and fiber producers themselves can't survive if they don't exercise prudent conservation of their own natural resources. Today then, environmental education in an effective sense of the term is permeating CES programs.

This case study is a detailed description of the emerging many-faceted role of one state's conventional remodeled ag college outreach. The Maryland situation is in contradistinction to the Wisconsin case study, wherein Extension represents all the colleges within 13 universities in a state system. Which model is the more efficacious has yet to be determined. Significantly, this Maryland state case report is more comprehensive and sensitive than one developed by federal personnel on the CES as a whole for the editors' earlier compilation on environmental education in action, typifying an important CES characteristic: it is essentially a state-by-state program, not a set of packaged materials from Washington, so it tends to be highly responsive to felt local needs.

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The Maryland Cooperative Extension Service

Purpose

The Maryland Cooperative Extension Service (MCES) is an informal, out-of-school system of adult and youth education in which people learn by doing. Funding and other support for MCES activities are provided through cooperative agreements between the United States Department of Agriculture (USDA), the University of Maryland, and each of Maryland's 24 major political subdivisions (23 counties and Baltimore City). MCES interprets and applies knowledge and techniques developed at the university to the educational needs of Maryland residents in five areas: (1) agricultural science and natural resource management; (2) community and resource development; (3) home economics; (4) 4-H and youth; and (5) marine programs.

Staffing

To accomplish its mission, MCES utilizes expertise from throughout the University of Maryland. Its structure consists of field faculty (Extension agents) located in each of Maryland's 24 political subdivisions, subject matter specialists located in departments of the College Park and Eastern Shore campuses and the Center for Environmental and Estuarine Studies, and an administrative unit. Agents and specialists are generally assigned to a specific subject area (e.g. agriculture). They provide educational programs to citizens in the jurisdictions they serve. Specialists assist agents and other clientele throughout the state.

Program Development

MCES educational programs are designed and conducted with the intention of producing a specific predetermined and measurable change in the behavior of the people it serves. MCES believes that its programs must start at people's existing educational level, but that they must be able to guide people to a higher level of learning and assist them in applying their newly gained knowledge to the solution of life's problems.

The development of an MCES program involves the participation of many people, both within and outside the University of Maryland system. Within MCES, inputs are received from three groups: (1) administrators who provide guidance on matters of general university and USDA policy; (2) subject matter specialists; and (3) county Extension agents.

MCES believes that its programs will be relevant to the needs of Maryland residents only when people outside the university system are involved in program development. Each of the 24 MCES field offices and several of the academic departments at the university have established advisory groups to assist in identifying local and/or state needs and priorities in agriculture and natural resources, community and resource development, home economics, 4-H and youth, and marine programs. The members of the planning groups reflect the characteristics of the general audiences being served in each of the five subject areas. Within this organizational framework, MCES programs emerge from three sources: (1) audience-generated programs identified by the clientele being served; (2) research-and-technology-generated programs in which research findings are diffused to clientele; and (3) conditions-of-society-generated programs as determined by legislation or social trends.

Having identified a particular program need, MCES believes that a seven-link chain of events must take place before a behaviorial change can be effected within a target audience. First in the chain are inputs, the planning of a program or curriculum and the preparation of procurement of materials to be used in the program (e.g. newsletters, fact sheets, demonstration plots, variety trials, newspaper articles, radio and TV tapes, slide-tape programs, films etc.). These inputs are used in conducting teaching activities, (e.g. workshops, seminars, conferences, tours, demonstrations, fairs, etc.) which involve clientele. Involved clientele have reactions to the activities, both pro and con. Clientele who have reacted to the teaching activities may change their knowledge, attitudes, skills and aspirations (KASA). Practice change occurs when involved clientele apply their KASA changes to living and working. When all members of the identified target audience have adopted the practice change, the end results or expected behavioral changes have been achieved. These seven events essentially define the work of MCES personnel, the aspirations of MCES programs, and the framework used for program evaluation.

Environmental Education in Maryland Cooperative Extension Service Programs

While MCES does not conduct any programs that are specifically labeled environmental education, it does have a vast array of programs that are oriented toward helping Maryland citizens achieve and maintain high quality working and living environments. These programs can be identified as serving the environmental educational needs of three audiences: (1) the farmer and the impact of farm management on environmental quality; (2) the community and the impact of public decisions on environmental quality; and (3) the homeowner and environmental quality.

Farm Management As It Impacts Environmental Quality

Maryland is part of the east coast megalopolitan corridor that extends from Richmond, Virginia, to Boston, Massachusetts. Consequently, Maryland's image, as projected from its major transportation arteries, is one of highly urbanized or unbanizing land. In spite of the high density of land use found in the state, particularly between Washington and Baltimore, Maryland's agricultural community contributes approximately 14 percent of the state's annual gross product. Like many other regions of the country, the agricultural "green revolution" of the 1950's and '60's has mandated more intensive management and has resulted in higher yields from Maryland's agricultural resource base. At the same time, the rising tide of environmentalism has also resulted in a closer evaluation of the impact of farm management practices on the quality of environmental resources. MCES agricultural programs have consequently focused on helping the Maryland farmer realize the higher yields that are capable with more intensive management practices, without creating unacceptable degradation of environmental resources. These programs have stressed pest management, pesticide applicator training, sediment and erosion control, and animal waste management.

Pest Management. Many different insects attack crops in Maryland. Controlling these pests must be done in an economical and environmentally sound manner. Pest management takes into consideration the practices, economics, and other factors necessary to accomplish the control of insects and other pests.

Two innovative pest management programs introduced to Maryland by MCES are the use of beneficial insects and an agricultural weather network. The Mexican bean beetle is a highly destructive insect that has plagued Maryland soybean farmers. Initial beetle control measures involved the use of pesticide sprays. Extension entomologists now work with the Maryland Agricultural Experiment Station and farmers to control biologically the beetle by introducing a tiny parasitic wasp (Pediobus foveolatus) into soybean fields. Although harmless to humans and other species, the wasp kills the bean beetle larva. In 1976, use of pesticides to control the bean beetle was greatly reduced because of the success of this program.

The successful prediction of crop disease outbreaks is dependent upon the close monitoring of temperature and moisture levels. For example, although it is not practical to do field checks for the pupae of the alfalfa caterpillar, research has shown that insect egg and larva development can be predicted by accumulating temperature and moisture data during the growth of the plant. MCES has trained volunteer weather observers to gather local weather information and forward it, via telephone, to the National Weather Service computer where it is used for forecasting purposes. In 1975, one alfalfa farmer, relying on weather as a predictor, was able to reduce pesticide use by 20 percent while still controlling the alfalfa caterpillar.

Pesticide Applicator Training. The Maryland Pesticide Applicator Law requires the certification of users of certain restricted-use pesticides by the Maryland Department of Agriculture. MCES personnel are supplying much of the education and training for applicators in Maryland. Training emphasizes correct and safe use of pesticides, as well as proper storage and disposal. To date, approximately 6000 applicators have been trained and certified.

Sediment and Erosion Control. As noted in Chapter 15 of *Environmental Education in Action--I* (Jenkins, *et al*., 1977), Cooperative Extension Services throughout the nation have historically conducted programs aimed at reducing soil erosion resulting from farm management practices. Much of this activity in Maryland has been directed toward encouraging farmers to adopt such conservation practices as contour plowing, use of cover crops and grassed waterways, terracing, and sediment control ponds. This work is implemented in close cooperation with local soil conservation districts and the USDA - Soil Conservation Service.

A significant portion of MCES activities in sediment and erosion control currently emphasizes the no-till method of farming. The no-till method of producing crops consists of planting directly into an unprepared seedbed. With proper use of herbicides, no-till can be environmentally beneficial in that it reduces runoff. No-till farming also conserves energy by decreasing plowing, disking and cultivation requirements and their inherent use of fossil fuels. MCES has encouraged no-till cropping with proper use of herbicides. In 1970, only 50,000 acres of no-till crops were grown in Maryland. In 1976, this no-till acreage increased to 350,000 acres. In one Maryland county, over 70 percent of the corn acreage has been planted using this technique.

Waste Management. Livestock farmers in Maryland have the potential to be sources of water and air pollution. MCES livestock programs emphasize proper waste management practices to reduce the potential adverse environmental consequences of livestock operations. These programs provide information relative to the selection, design and construction of animal waste systems including lagoons, spray irrigation of effluent onto forests and cropland, proper location of livestock on farms, and techniques for incorporating animal wastes into soil.

Many seafood and agricultural processors in Maryland use large volumes of water in their operations. MCES provides education and technical assistance to food processors concerning water recycling, and it recommends environmentally sound methods of disposing of the seafood, animal and/or vegetable by-products.

Public Decisions on Environmental Quality

In addition to helping the farmer manage his farm in an environmentally sound manner, MCES also provides assistance to communities at the federal, state and local levels who are considering public decisions that will affect environmental quality. These programs focus on water quality, coastal resource management, land use planning, forest management, community facilities and services, and youth involvement in environmental management.

Water Quality. Water quality in Maryland has always been and continues to be a vital educational issue for the MCES. Extension personnel work with soil conservation districts and other agencies to provide sound education in the management of water resources.

Extension agents serve as educational secretaries to most of the state's 24 soil conservation districts. District activities vary depending upon geographic location in the state. In Appalachian Western Maryland, educational activities focus on strip-mine reclamation. MCES has assisted the soil conservation districts and the Bureau of Mines in evaluating current strip mining practices and developing procedures for strip mine revegetation. These practices have reduced erosion and siltation of adjacent streams.

Maryland's Eastern Shore has minimal topographic relief and a high water table. Consequently, soil conservation district educational activities on the Shore focus on farm and community drainage. Wet fields are difficult to till, and communities are often inundated with standing water, thereby creating a health hazard. Under a provision in Maryland law, people in these areas can form public drainage associations on a cost-sharing basis. Extension agents outline the procedures for forming public drainage associations. Over the years this program has resulted in improved community health and reduced crop losses to farmers.

In 1972, Congress enacted PL 92-500, the Federal Water Pollution Control Act Amendments. The act requires the development of state and area-wide management programs to institute abatement measures for all pollutants, and it requires states to conduct planning activities related to improving water quality within entire river basins. Maryland's continuing water quality planning process requires that these river basin plans focus on control of pollutants from point sources, such as municipal and wastewater treatment facilities, and non-point sources. Because of the potential impact of this law on Maryland's agricultural community, MCES has been involved in the following activities related to PL 92-500:

1. Extension agents are members of the 19 river basin planning groups as well as the Baltimore Regional Planning Council and Washington Council of Governments. Agents provide educational and technical assistance to planners, especially as the plans relate to non-point source pollution from agriculture.

2. MCES prepares articles on non-point source pollution covering policy and technical considerations.

3. MCES is a member of a statewide multiagency ad hoc committee whose mission is to assist in determining state policy and direction for non-point source pollution planning in Maryland.

4. As research data from the university and other sources concerning non-point source pollution become available, MCES will continue to provide findings to relevant publics.

Maryland's post-World War II population growth has resulted in MCES soil management programs that focus on the capacity of soils to renovate wastewater emanating from increased urbanization. In urbanizing counties, new on-site waste disposal systems are being installed at the rate of 9,000 to 14,000 per year. This has resulted in an increased demand on the soil as a medium for waste disposal and renovation. To protect the public health, county health departments must be more aware of soil properties as they relate to waste water assimilative and renovative capabilities. Extension and USDA Soil Conservation Service scientists conduct special courses, symposia, seminars and field trips to teach county sanitarians the principles of rural waste disposal, septic systems and their alternatives, renovative capacity of various soils, lagoon systems, etc. In 1973, a grant was received from the Department of Health, Education and Welfare (HEW) to conduct an advanced, three-credit college course for county sanitarians. The course stimulated health officials to include soil data in state waste disposal guidelines.

Coastal Resource Management. The optimization of the values derived from the various, and sometimes competing, uses of the coastal zone is the principal focus of Maryland's efforts to manage its coastal resources. MCES has been involved in coastal resource management programs that have focused on: (1) developing a broader understanding of the interconnected nature of coastal resource management issues so that management decisions will reflect a wider range of resource values; (2) providing technical assistance to state agency personnel in the design and implementation of coastal resource management programs; and (3) improving the managerial skills and technical knowledge of commercial fishermen, or watermen as they are known in Maryland.

MCES programs on public consideration of coastal resource management issues have used a variety of methods. A series of four information sheets distributed to over 3000 citizens and weekly radio programs on 14 local stations have discussed a variety of topics related to coastal resource management. Coastal zone management conferences and seminars for public officials and interested citizens have been cosponsored with citizen, industrial and special interest groups. As part of a program in one of Maryland's lower Eastern Shore counties, information sheets dealing with coastal wetlands management were prepared and distributed to local community leaders. These leaders were invited to discuss their perspectives on the issues raised in the publications, and several wetlands tours were conducted. Partially as a result of this program, a cooperative multistate program is being planned to provide insight for community leaders in counties fronting the Atlantic Ocean on dealing with the impacts of development on coastal communities.

MCES has assisted personnel in the Maryland Department of Natural Resources (DNR) in designing and implementing measures to gain wider public participation in the Maryland Coastal Zone Management Program. These activities have included gathering and interpreting research studies on public participation, training of DNR personnel in locating and working with community leaders and identifying local issues, and preparing materials for use in DNR's public education program. The Coastal Zone Public Participation Program has evoked responses from over 1,000 citizens in the Maryland coastal zone.

Extension programs relating to the resource management needs of the commercial fisheries industry are being developed by the Marine Advisory Program (MAP), a component of MCES. MAP environmentally related programs currently focus on developing among fishermen a better understanding of the common property nature of marine fisheries and its implications on management policies, and assisting the seafood industry in adopting improved methods of harvesting, handling, processing fish and shellfish, and disposing of waste by-products.

Land Use Planning. Planning for the most appropriate use of land resources has been a long-standing component of MCES programs. Historically, Extension land use programs focused on planning decisions made on a fairly small scale, the farm unit, by a specialized segment of society, the farmer. Emphasis was placed on helping the farmer to match his crop production expectations with the capabilities of his soil resource. However, with the development of a sense of environmental consciousness throughout society and a population explosion in many parts of Maryland during the 1950's, '60's and '70's, MCES has expanded the scope of its land use education programs.

Today's MCES land use education programs are designed to improve the land use decision-making process by encouraging wider participation in and debate about land use questions, the alternatives available, and the possible impacts of the various alternatives. Most MCES land use program activities currently focus, within this broad framework, upon two sets of issues: the development of land use policies that will encourage the maintenance of a viable agricultural resource base for Maryland, and a full consideration of the environmental and fiscal impacts associate with new growth in the state.

During its 1973 general session, the Maryland State Senate directed the Secretary of the Maryland Department of Agriculture to develop a comprehensive plan for preserving agricultural land. The Secretary appointed an advisory committee to help him develop the plan. The committee was divided into seven subcommittees to investigate various issues. Several MCES specialists served as technical consultants to the subcommittees.

Following the completion of the full committee's report, MCES undertook an extensive educational program to explain the committee's recommendations to the public. This effort included the preparation of written material such as press releases and fact sheets, but generally focused upon a series of meetings conducted in each of Maryland's 23 counties. County Extension agents were assisted in these meetings by specialists from the state office. In addition, MCES sponsored a seminar on land use controls pertaining to agricultural land preservation. Nationally recognized authorities on land use controls presented papers on the benefits and costs of various agricultural land preservation techniques. The seminar was attended by over 200 local and state public officials from all over Maryland.

Following the passage of legislation enabling the creation of County Agricultural Preservation Advisory Boards, several of Maryland's counties are developing policies concerning the preservation of agricultural land. In six of these counties, MCES agents and specialists have played a significant role in explaining to both public officials and the general public the alternative mechanisms that might be considered.

MCES programs related to the impacts of community growth are more prevalent in those counties on the fringes of existing metropolitan areas. These programs are cooperative efforts between MCES, local planning commissions, interested citizens associations (e.g., the League of Women Voters) and the regional offices of various state agencies. The main objectives of these programs are to encourage and facilitate wider citizen involvement in the land use decision-making process, and to develop in community leaders a better understanding of the complexities and interrelationships inherent in land use decision making.

A variety of educational methods have been employed in these growth-related programs. One county program, funded through Title I of the Higher Education Act of 1965, created a coalition of community leaders who discussed local issues at a series of forums. Each forum was organized around a separate issue, and experts from government agencies moderated and helped direct the debate. Each participant was encouraged to prepare position papers which were printed and distributed to members of the coalition. Subsequently, a speakers bureau was formed to disseminate the knowledge to other segments of the community. Seventeen position papers were prepared and members of the speakers bureau addressed 31 community organization meetings. The forum approach has been attempted in two other counties. In one county, MCES cosponsored a 2-day conference on local land use issues. MCES personnel helped organize the conference and moderated several of the sessions. As an outgrowth of this conference, MCES helped organize and support a coalition of community leaders to review current land use policies in the county. In at least two other counties, Extension agents are facilitating the activities of technical advisory bodies designed to review and comment on growth proposals in the county.

Forest Management. Nearly 40 percent of Maryland's approximately 6 million acres of land area is covered by a forest capable of producing a marketable forest product. In spite of this bountiful forest resource, only 30 percent of the state's commercially valuable forests are intensively managed. This is largely a result of three factors: (1) much of the better quality timber was harvested during the early 20th century, leaving marginal stands that have taken many years to regenerate; (2) 90 percent of the state's forest area is owned by private landowners who have little training in modern forestry principles; and (3) local commercial markets for Maryland's forest products are scarce.

Recognizing a need to improve the knowledge of Maryland's small woodlot owners concerning proper management techniques and forest product markets, MCES maintains an active forestry program that has two objectives: (1) to motivate private forest land owners to properly manage their forests; and (2) to inform the general public on the values of the state's forest resources. Many methods are used to reach the forest land owner, including tours of properly-managed forests and wood product processing facilities, woodland owner conferences and seminars, the establishment of plots demonstrating modern forestry practices, fact sheets on new developments in forestry, and extensive use of the news media. Between 1974 and 1977, 32 additional woodlot owners joined the Maryland Tree Farm Ststem, bringing the total membership to 250. These operators scientifically manage their timber resources.

As a result of the rapid post-World War II growth of Maryland's population, MCES has expanded its forestry education program to include urban forestry and all-purpose management of the state's public forests. MCES personnal conduct continuing education programs, prepare written material and maintain a telephone hotline service to provide instruction to homeowners and public officials on the proper selection and care of trees in urban and suburban conditions. State forest land managers are receiving training in subjects such as planning for the recreational use of state forests and visual resource management.

Community Facilities and Services. The development and maintenance of an adequate system of community facilities and services are critical to the existence of a high quality living environment. Many of these facilities and services, such as those relating to education, leisure and recreation, and water supply and sewage disposal, must be provided and maintained by government agencies.

MCES has played a continuing role in the development and maintenance of an adequate system of community facilities and services in the nonmetropolitan communities of Maryland. The MCES role has focused on three areas: (1) identifying the need for new facilties and services; (2) identifying and securing the resources necessary for the development of needed facilities and services; and (3) improving the function and appearance of existing and new facilities once they are constructed.

MCES programs in leadership development and community organization have often provided the impetus and organizational framework necessary for a community to examine comprehensively the needs of its citizens. Workshops, seminars and other continuing education programs have provided the technical insight required to understand fully a community problem and develop and evaluate alternative solutions to the problem. In many instances, MCES personnel have been instrumental in the identification and procurement of the resources needed to resolve community problems. All of the 24 MCES field offices now have the capability to tie into the Federal Assistance Program Retrieval System (FAPRS), a computerized system developed by the USDA-Rural Development Service to assist local and state governments in locating sources of federal domestic assistance for community development programs. Recent examples of community facility and service developments resulting from MCES programs include the creation of an economic development commission in a rapidly growing county, the development of information and referral services for two counties, the construction of a new public housing project, and the extension of public water and severage service into a rural community.

In addition to these developmental activities, MCES programs have provided assistance to communities wishing to improve the appearance and function of existing facilities. Annually MCES conducts continuing education programs for public grounds maintenance supervisors and it has, in the past three years, assisted community groups in the preparation of site development plans for over 25 community facilities. Such assistance has been given on projects ranging from schools, civic centers and local parks to the National 4-H Center. In addition, MCES helps coordinate and conduct the annual Federated Garden Clubs of Maryland Landscape Design Study School. Many of the graduates of this program have used their expertise in landscape design as members of local park commissions, architectural review committees and other local civic organizations created to improve the function and appearance of community facilities.

Youth Involvement in Environmental Management. Since 1938, the primary MCES thrust for youth involvement in environmental management has been the annual State 4-H and Youth Conservation Camp. The camp program usually spans five-to-six-day period in the early weeks of summer, and it is designed specifically to serve Maryland youth between the ages of 14 and 19. The location of the camp varies from year to year in an attempt to give repeating program participants an exposure to the variety of ecological systems found in Maryland's three physiographic provinces (Coastal Plain, Piedmont and Appalachian). Campers are selected from around the state on the basis of their interest in environmental science and natural resource management, as demonstrated either in 4-H Club or school activities.

Experiential learning is a central theme to all 4-H program activities. While campers are provided with traditional learning experiences in the form of lectures by specialists, slides, movies and printed material, they are expected by the end of each camp program to demonstrate their newly gained knowledge. To accomplish this major program to demonstrate their newly gained knowledge. To accomplish this major program objective, such teaching methods as group projects, games and simulations have been used extensively. In the past four years campers have prepared land use plans for a three-square-mile parcel of land in Western Maryland and defended their plans before a moot public hearing, prepared an environmental impact statement for a new town on the shores of Chesapeake Bay and defended their findings before a moot public hearing, designed and implemented an interpretive natural program along the banks of the Potomac River, and and conducted a wildlife species diversity inventory in the Appalachian Mountains. Each year's program is designed specifically to give the campers an exposure to new ideas in environmental resource management and the skills necessary to use the new ideas both as participants in the experiential learning activity at camp and as productive members of their respective communities.

The Homeowner and Environmental Quality

MCES homeowner and environmental quality programs focus on the development and maintenance of a high quality home environment both indoors and outdoors. Indoor environmental education programs focus on developing a knowledge of textiles and home furnishings and using this knowledge in the design of interior environments to suit family needs. Outdoor environmental education programs for homeowners focus on the design of home grounds, the selection and care of ornamental plants in home grounds design, including pruning, fertilizing and controlling disease and insect problems, and soil testing through the MCES soil testing laboratory. All of these programs are conducted through meetings, demonstrations, fact sheets, newspaper acticles and radio and television programs.

Future Trends and Priorities in MCES Environmental Education Programs

Because all of the current MCES environmental education programs are helping the citizens of Maryland resolve environmental problems that they or their communities must face, there is little probability that any of these programs will be curtailed in the immediate future. However, as program implementation resources become harder to secure, MCES will need to take a critical look at all of its programs and establish program priorities for future resource allocation. It is likely that in the future, MCES will concentrate on environmental education in its areas of expertise.

The issue of agriculture and its impact on environmental quality, particularly water quality, will continue to be an area of emphasis for MCES. Agents and specialists will continue to provide technical assistance to agencies developing regional water quality plans as well as educational programs to explain the impact of these plans on agriculture. A long range objective of MCES and various other state and federal agencies is to have every farm in the state operating under a farm conservation plan. Extension's role will emphasize increasing farmers' awareness of the need for such plans, providing technical information to farmers to help them develop conservation plans, and helping farmers with overall farm management practices once plans have been implemented.

Because of its relevance to one of Extension's largest clientele groups, the agricultural community, the issue of agricultural land preservation will continue to be high on the list of MCES priorities. With more of Maryland's counties attempting to develop preservation policies of their own, MCES activity in this area of environmental education will increase.

As the Maryland Coastal Zone Management Program moves toward implementation, MCES involvement in coastal resource management will continue to stress: (1) public understanding of coastal issues and participation in decision making; (2) helping public officials cope with the impacts of coastal resource development; and (3) diffusing technical knowledge to the Maryland seafood industry. As the Marine Advisory Program becomes more of an established MCES Program, Extension activities will focus on the economics of seafood harvesting and handling, the enviromental implications of seafood processing and the impact of the recreation industry on the coastal environment.

The provision of needed community facilities and an adequate housing stock for Maryland's rural residents will continue to be an emphasis for MCES. In this respect, the provision of educational programs on housing alternatives and interagency coordination among the various federal and state housing agencies will become important functions of MCES agents and personnel.

Finally, the grass roots role of MCES agents in leadership development and community organization will continue to provide the organizational framework needed to tackle environmental problems.

New areas in which MCES environmental education programs will likely emerge include energy and training of local public officials. With the advent of federal funding to support Extension-type programs in energy education, it is likely that MCES will develop programs to assist various clientele groups in: (1) understanding the magnitude of the energy supply problem, as well as what is being done to solve it; (2) changing attitudes toward energy use; (3) adopting conservation practices; and (4) convincing friends and neighbors to follow suit. Training for local public officials will likely emphasize management principles and the public policy making process. While these training programs will not be specifically oriented toward environmental problems, the knowledge gained by participating officials will be applicable to many issues in environmental management (e.g., evaluating the fiscal and environmental impacts of growth in a local jurisdiction).

As new environmental education needs arise in subjects relevant to MCES expertise, the organization will continue to provide up-to-date educational programs to interested clientele throughout the state.

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CENTER FOR ENVIRONMENTAL EDUCATION AT MURRAY STATE UNIVERSITY, KENTUCKY

by Shaw Blankenship and Lynn M. Hodges*

While environmental education can be identified in some degree in each of Murray State (Kentucky) University's programs, this case study focuses on the Center for Environmental Education in the College of Human Development and Learning's Department of Instruction and Learning--all of which is a fancy name for a school of education. Concerned primarily with public education and educators, the work of the Center and its support represent unique cooperation among the University and its resources, a West Kentucky Environmental Education Consortium of eleven public school systems and the Tennessee Valley Authority. Through publications, national conferences, and demonstration projects at nearby Land Between the Lakes, Murray State's modest EE Center has had an impact far beyond Kentucky.

Introduction

Murray State University, with an enrollment of approximately 8350 students and a teaching faculty of 360, is a tax-supported university located in West Kentucky's lake country. Sixty buildings dot the university's 238-acre main campus in residential Murray, a city with a population of 16,000. Murray is within 500 miles of 50 percent of the nation's population. Nearby major cities include Nashville, Memphis, St. Louis, Evansville and Louisville.

Murray State is dedicated to preserving and utilizing the natural resources of the region. The university owns and maintains Murphy's Pond, one of the most unique wildlife environments in the United States.

Murray State's special efforts to provide continuing and enriching educational opportunities throughout West Kentucky through the use of such unique educational resources as the Land Between the Lakes, Murphy's Pond, Kentucky and Barkley Lakes, and the surrounding environment have brought the institution national recognition.

While environmental education can be identified in some degree in each of the colleges' programs of studies, the College of Environmental Sciences and the College of Human Development and Learning have more formalized

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programs. The College of Environmental Sciences deals with career training in the technical fields, while the College of Human Development and Learning offers courses of study for students and professional educators at all levels. This paper will emphasize a program found in the College of Human Development and Learning's Department of Instruction and Learning—the Center for Environmental Education.

Purpose

The Center for Environmental Education is designed to provide a key mechanism for the most efficient use of resources and the most productive provision of services among Murray State University, schools systems participating in the West Kentucky Environmental Education Consortium (WKEEC), the Tennessee Valley Authority (TVA), and other local, state, and federal agencies or organizations with interest in environmental education. Through this coordination and service role, Murray State University is implementing the priority functions for higher education identified in Kentucky's plan for environmental education.

The major functions of the Center for Environmental Education are: 1) Inservice; 2) Preservice; 3) Program development; and 4) Research.

Inservice

Inservice training of teachers is primarily the responsibility of the public school system. The Center for Environmental Education assists the public school system by housing the main offices of the WKEEC and by providing consultant services, planning and implementation assistance for workshops, program development services to individual teachers, access to resource materials for environmental education, and assistance with identification, development, and utilization of significant environmental study sites within the region. One example of this coordination function of the Center for Environmental Education is the mobile environmental van made available to teachers throughout the WKEEC area. A converted van, furnished by TVA and driven and programmed by a TVA student-intern, is filled with environmental study aides, special free materials, and assorted educational tools designed to assist teachers with implementation of environmental education activities. The Center for Environmental Education manages the scheduling of the van, provides the educational materials, supervises the student-intern, and promotes use of the van in the area. It also makes periodic evaluations of the effectiveness of the van program.

Preservice

As identified by Guidelines for Environmental Education: The Kentucky Plan, preservice teacher training in environmental education is the first priority given teacher training institutions in Kentucky through their respective colleges of education. In meeting this mandate, Murray State is developing and implementing a program requiring both classroom and field experiences in environmental education for all elementary and secondary education teacher candidates. The program includes the interdisciplinary process-oriented approaches to teaching that emphasize utilization of local resources as tools for instilling an environmental ethic. Also required is a one-weekend residential experience at TVA's Land Between the Lakes Environmental Education Center. Instruction activities for the weekends are provided by Murray State University and TVA staff members as well as by graduate intern students of environmental education.

To expose the non-education student to environmental education, environmental education techniques and environmental concepts are being included in a variety of program areas. Such programming necessitates some course modification and occasional adaptation of teaching style by the university faculty. Providing the mechanism for such alterations is a major challenge to the Center for Environmental Education.

Program Development

As a major focal point for environmental education in the region, the Center for Environmental Education coordinates the inputs and resources of various groups, agencies, and organizations to meet specific program needs of the region. Specific programs, such as energy conservation, land use planning, local and regional problems, and wilderness appreciation, and innovative curriculum systems, such as computer-based resources, are generated and administered through the Center. Both formal and nonformal approaches are used. The piloting and evaluation of environmental education programs is a function of the Center, and utilization of existing facilities and the planning of new facilities for program implementation provide support for new programs.

Murray State University offers the master's degree in education with an emphasis in environmental education. New degree programs (such as the master's degree in environmental education and the Ed.S. with an emphasis in environmental education) are currently under review by the College of Human Development and Learning. New courses are offered periodically to supplement the current environmental education course of study. Frequently these supplemental courses are taught or partially taught by professionals from outside the traditional university community—TVA has contributed much assistance.

Research

As the leader in educational research in West Kentucky, Murray State University disseminates information and conducts research relating to environmental education. The Center for Environmental Education serves as the liaison between the University and the groups and organizations needing specific research services.

Funding Sources

Funding for the Center for Environmental Education is obtained primarily from three sources: Murray State University, the public school systems comprising the West Kentucky Environmental Education Consortium, and TVA. The funding provided by Murray State and WKEEC is an annual assessment and is the major portion of the present budget. TVA's contribution was primarily "seed" monies establishing the program effort; continued contributions from TVA are negotiated contractually. Currently, the Center requires an annual budget of approximately fifty thousand dollars. Outside funding is solicited by the Center from many sources. Some funds, especially those for scholarships and subsidy fees for students and teachers, have been obtained from local wood products industries and from the Kentucky Association of Conservation Districts. Several gifts of books, materials, and teaching tools have been donated to the Center's resource materials collection.

Target Audiences

The formal and non-formal environmental education effort from the Center for Environmental Education has as its audience both the educator and the general citizen. Although the most significant developments have been in the formal realm, the Center plans to expand its activities to have an impact on the non-formal realm as well. The emphasis within the formal structure has been in the inservice of practicing teachers, including selected university staff, and in the preservice of teacher candidates through their program of studies. As the research capability of the Center for Environmental Education matures, a clientele of several resource management and environmentally-concerned organizations will emerge as a major target group.

History

Murray State University, like other Kentucky teacher training institutions, began courses in conservation education in the early '40s. This initial effort was in response to both actual interest from university administration and the legislative mandate that "conservation will be included in the curriculum of the public schools of Kentucky." Courses in conservation were continued through the '40s, '50s, and '60s and constituted Murray State's major efforts in environmental education during this time.

With the establishment of a national demonstration center in outdoor recreation and environmental education only twenty miles from the Murray campus—TVA's Land Between the Lakes—the university's interest in environmental education was renewed. As the Land Between the Lakes demonstration grew and gained national recognition, the university initiated teacher training workshops using the facilities of Land Between the Lakes. The first workshop was held in the summer of 1970. TVA staff participated as adjunct professors and taught the course. The popularity of and student interest in the week-long residential workshop insured its continuation. The workshop and the traditional conservation course were eventually to form the base on which the environmental education course of studies was built.

Another Murray State University program with strong ties to Land Between the Lakes is Project Apollo. Project Apollo is a national demonstration funded through a grant from the Office of Student Assistance in the Department of Health, Education and Welfare. Apollo is an outdoor curriculum enrichment program for Upward Bound.

A significant event in the summer of 1973 focused national attention on Murray State University and environmental education—the annual national conference of the Conservation Education Association (CEA) was held at Murray State University. As the host for CEA, Murray State compiled an inventory of environmental education sites and resources in west Kentucky. This information was used to plan field trips and special programs for the conference participants. Land Between the Lakes was a major attraction, but other natural and scenic areas were included. With the hosting of this conference, the University made a strong commitment to expansion and development of an environmental education program.

The first major structural change in the University was the reorganization of the traditional science college into the College of Environmental Sciences. A coordinator was appointed to administer the environmental programs at the university level and to act as liaison between the University and local, state, and federal agencies with environmental concerns. The newly appointed president of the University strongly supported the regional role of Murray State in supporting and promoting environmental education. His keynote address, "Dividends for the Future," to the University of Southwestern Louisiana seminar on conservation education formally outlined the benefits of environmental education and the commitment of higher education to environmental education and identified the plan for implementing a major effort at Murray State. Subsequent changes were made in the development of an environmental education advisory group: the combination of environmentally-related disciplines (sciences, sociology, economics) into environmental study task forces, and the emphasis on teacher education in the process of environmental education.

Commitment to environmental education went beyond the program level. Because of the success of Land Between the Lakes, Murray State recognized the value of off-campus sites and facilities. A freshwater laboratory was constructed on Kentucky Lake. This biological station serves as a direct collection point and analysis center for a wide range of water-related studies on the lake. Also identified by the University as important for its environmental studies program (and subsequently purchased by it) was Murphy's Pond, a natural swamp-pond area consisting of 255 acres with an extremely high concentration of reptiles, amphibians, and unique flora.

The University became a regional resource for environmental education with the formation of the West Kentucky Environmental Education Consortium (WKEEC). Initiated through the efforts of TVA and MSU, this association of eleven school systems became the local implementation mechanism of the inservice function of the University.

The Consortium was formed in 1976 by eleven school systems which jointly committed their resources to the development of a regional environmental education program that utilizes the physical, cultural, and social resources of the region.

WKEEC pools existing program information, special expertise, and experiences of the participating districts for environmental education. Through cooperative efforts, a full-time coordinator or regional director of environmental education activities was hired. Through its unity, the Consortium can implement programs that would not be feasible if only a single system were attempting them. The funding potential of an organized consortium is greater than that of a single system, especially when applying for grants or requesting matching funds.

The organizational structure of WKEEC allows for input for all levels of educators, from the classroom teacher to administration. A board of directors comprised of superintendents from each participating school system identifies and approves programs and activities. The director implements those projects and serves as full-time consultant to the schools. A steering committee, made up of individuals appointed by each superintendent, acts as a "think tank" group. The advisory council members are environmental education resource representatives from formal and non-formal educational programs. This council updates the director about funding opportunities, innovative concepts, and other diverse programs.

The WKEEC network includes the director, system coordinators, and school contacts.

The eleven school systems forming the WKEEC are (1) Ballard County Schools, (2) Calloway County Schools, (3) Carlisle County Schools, (4) Fulton City School, (5) Fulton County Schools, (6) Hickman County Schools, (7) Marshall County Schools, (8) Mayfield City Schools, (9) McCracken County Schools, (10) Murray City Schools, and (11) Paducah City Schools.

The impact of the WKEEC on the University was significant. Greater demands for teacher training, consultant services, and dissemination of materials prompted the development of the Center for Environmental Education. The Center for Environmental Education grew to encompass the University's efforts as well as the service role to the WKEEC. The WKEEC remains an integral part of the Center for Environmental Education, yet it is separate from the university structure. Both the University and WKEEC contribute financially to the Center for Environmental Education. Continued support from TVA has been negotiated on the premise that the development of the Murray State Center for Environmental Education can serve as a model for similar developments throughout the seven states of the TVA region.

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CURRICULAR INNOVATION IN A LAND-GRANT INSTITUTION: INTERNATIONAL ENVIRONMENTAL STUDIES AT COOK COLLEGE, RUTGERS UNIVERSITY, NEW JERSEY

by Baruch Boxer*

How do you take traditional agriculture-based teaching and research programs into an era of global environmental concerns? How do you integrate liberal and vocationally-oriented programs of undergraduate study? How do you overcome the demands for conformity that accompany institutional retrenchment in a period of declining resources? How do you assure students of the practicality of pursuing any studies that fall outside conventional disciplinary molds? Such challenges are being met in an unusual way by Rutgers (New Jersey) University's new Cook College, which in itself represents an unusual marriage of agricultural and environmental sciences. The College has committed itself to extending the land-grant concept of integrated teaching, research, and community involvement to a variety of multidisciplinary, environment-related programs in the physical and biological sciences and the liberal arts. One such effort is an International Environmental Studies undergraduate curriculum based in the Department of Human Ecology and Social Science. In this case study we find evidence of remarkable support from state and university resources, the U. S. Office of Education, the United Nations Environment Program, and the cooperation of the National Academy of Sciences, the U. S. State Department, and the Institute of International Education. The Cook IES program is new; it has had only three graduates to the end of 1977. But it seems to be on a global course.

Background

Educational theorists and policymakers have frequently observed that the liberal arts as traditionally organized in American universities are no longer meeting the demands of an increasingly job-oriented undergraduate student population. There is therefore much interest in the relationship between liberal and vocational educational values and practices in various institutional settings. There has also been growing criticism of the land-grant colleges for their failure to adjust traditional

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agriculture-based teaching and research programs so that they can be more responsive to such global concerns as pollution, the need for energy alternatives, food supply, nuclear proliferation, population growth, the social and behavioral consequences of malnutrition, and the environmental consequences of climatic change.

Furthermore, while there is currently great national interest in the potential advantages to learners of integrating liberal and vocationally-oriented programs of study, the need to rely upon traditional discipline-based curricula and the administrative structures that support them has tended to retard experimentation with innovative curricula in most post-secondary institutions. This problem has been further compounded by the growing demands for conformity which accompany institutional retrenchment in a period of declining resources.

These demands are not only stifling creativity on the part of faculty and administrators, but are having the more serious and permanent effect of raising doubts in students' minds as to the advisability of pursuing any studies which fall outside of conventional disciplinary molds.

Yet attempts to devise workable and potentially replicable strategies for redesigning and augmenting existing undergraduate programs to achieve this integration have, for the most part, been unsuccessful. The ultimate losers, of course, are students who ideally should have the opportunity to pursue practical studies that will prepare them for job opportunities in both traditional and newly-emerging fields, while simultaneously enhancing their personal growth and awareness through exposure to the liberal arts.

Cook College (until 1973, the College of Agriculture and Environmental Sciences), the newest of the five undergraduate colleges of Rutgers University in New Brunswick, New Jersey, has responded to this challenge by committing itself to extending the land-grant concept of integrated teaching, research, and community involvement to a variety of multidisciplinary, environment-related programs in the physical, biological, and agricultural sciences and the liberal arts.

Beginning in 1974, this effort by the College's administration has led to the development of a number of multidisciplinary curricula, including International Environmental Studies, which combine existing offerings in creative ways, and which are undergirded by about a dozen general education courses, all of which have environmental content. The curricula are supervised by faculty curriculum coordinators who are responsible for organizing, evaluating, and administering the College's undergraduate course offerings.

Reorientation of the College's undergraduate mission has also encouraged the adoption of innovative strategies for combining practical, job-oriented training with newly introduced humanistic and social science perspectives on Man-Environment relations.

It is not surprising, therefore, that in this fertile climate, a number of faculty in the social, policy, and physical sciences at Cook were challenged to explore possibilities for developing a specifically internationally-oriented curriculum which would:

1. Explore regional and national differences in the availability, production, and use of natural resources;

2. Study the interdependence of nations and regions with respect to physical, biological, and social phenomena;

3. Compare variations in cultural perception of and response to environmental stress;

4. Identify alternate strategies in international environmental management;

5. Consider the ethical, moral, and legal components of global environmental issues; and

6. Explore the function and roles of trans-national corporations and governmental, international, and intergovernmental agencies in international environmental affairs.

Assumptions and Strategies

A basic assumption of the International Environmental Studies (IES) curriculum is that general understanding of the range and dimensions of globally-significant environmental concerns can be made personally meaningful for students only in the context of specific problem areas. The broad-based faculty group that began to develop the curriculum in the Fall of 1975 with support from the Division of International Education of the U.S. Office of Education struggled initially with the question of an appropriate balance between general, issues-oriented offerings and the need for structured, in-depth work in theory and method as traditionally defined by the physical, biological, and social sciences.

We also recognized at an early stage in the curriculum development process that only so much can be said in general about environmental issues and concerns which are just beginning to be recognized as important by the international community. In identifying appropriate foci for required core courses, therefore, we decided that these courses should serve primarily to:

1. Alert students to the various dimensions of such emerging problems as atmospheric pollution, desertification, the implications of ocean bed mining, and other Law of the Sea-related questions, or the global deterioration of agricultural production systems;

2. Provide clear evidence of the variety of institutional responses by governments and international agencies to environmental problems;

3. Underline the diverse range of localized social and cultural perceptions of these problems, as international response to environmental concerns tends to be based primarily on national, institutional or legal capabilities;

4. Encourage sensitivity to historical, cross-cultural, and evolutionary characteristics of international environmental problems; and

5. Help students identify and relate theoretical and applied material in the discipline courses which make up the largest part of their programs to such specialized areas of global environmental concern as: environmental health; agriculture and food supply; environmental constraints on development; ocean management; atmospheric pollution; climate change; and international pollution monitoring.

While we are obviously interested in solidifying the IES curriculum by attracting a significant number of major students, we also recognize the importance of broadening the perspectives of a larger number of students majoring in the other multidisciplinary curricula who might be interested in relating their work to international environmental concerns.

Completion of the IES curriculum's core courses serves this purpose for students in fields as diverse as environmental sciences, production agriculture, humanities and communication, human nutrition, resource management, and urban studies, as well as for others in discipline-based programs in the life, physical, and social sciences.

Our core courses begin with an introductory course, "Introduction to International Environmental Studies," taught by a geographer, which surveys major international environmental problems and points up difficulties in classifying them. It also accounts for regional and cultural variations in the identification of and response to environmental stress, and discusses alternative strategies in international environmental management, and the ethical and moral implications of global environmental issues.

"Environment and Development," taught by an anthropologist, examines differences among nations in environmental and development policies and the relations of these to physical and social factors. Three other new courses, also developed for the curriculum, are: "International Environmental Law," given by a lawyer, which examines environmental law in its international and comparative aspects; "Energy in World Perspective," jointly taught by a political scientist and a physicist, which presents basic scientific, technological, economic, and political aspects of energy, and discusses these in relation to energy supply and use in an international perspective; and "Environmental Problems in Historical and Cross-cultural Perspective," team-taught by historians and social scientists, which compares the historical experience of selected Old and New World societies in evolving strategies for adjusting to environmental constraints and opportunities.

Other required courses in the core curriculum include basic offerings in demography and international relations, basic and advanced courses in economics, and a Senior Colloquium in which senior IES majors develop in-depth studies of problems of interest to them.

Activities and Support Functions

U.S. Office of Education support began during Summer 1975, at which time the New Jersey Board of Higher Education authorized Rutgers University to offer courses of study leading to an A.B. or B.S. degree in International Environmental Studies. Formal adoption by Rutgers University of International Environmental Studies as an academically legitimate major was just as crucial in supporting our curriculum development work as the internal administrative arrangements in Cook College which supported the growth of multidisciplinary undergraduate programs.

Two years of Federal support, moreover, made it possible for us to institute a Faculty Development Seminar series. These seminars brought together about two dozen faculty, from both theoretical and applied areas in the physical, natural, agricultural and social sciences, and the humanities, to work on curriculum development. The Seminars, especially during the first year of Federal support (1975-1976), also served to bring older members of the Cook faculty, many of whom had considerable international experience in research or technical assistance work in agriculture or environmental science, together with newer members of the faculty who were brought to the College to initiate or strengthen new programs in International Environmental Studies, Human Ecology, Human Communication, and discipline-based majors in the humanities and social sciences.

U.S. Office of Education funding during the formative stage of the International Environmental Studies curriculum at Cook also facilitated our course development and teaching efforts by making it possible to involve students firsthand with officials of U.S. Government and international agencies involved in international environmental affairs, and with scientists working on problems relating to international environmental management.

We were also able to establish a close working relationship with the New York Liaison Office of the United Nations Environment Program. The director of this Office, in fact, became personally interested in the IES curriculum as a model curriculum which could serve to enhance student awareness of environmental issues and problems and stimulate them to seek solutions.

Symposia, seminars, and conferences in support of our teaching activities brought to the campus leading authorities in areas such as the environmental dimensions of ocean management, comparative approaches to environmental management in countries throughout the world, the environmental impacts of agricultural development, and alternatives to agricultural pesticides.

In May 1976, for example, we held a one-day symposium on "Environmental Dimensions of the United Nations Conference on the Law of the Sea." This conference brought to Rutgers delegates from developing and developed countries attending the Third United Nations Conference on the Law of the Sea. Also in attendance were members of the Secretariat of the Law of the Sea Conference and technical and legal experts from a major international oil company. In this conference, as well as in our other seminars and symposia held during 1975-76 and 1976-77, we were primarily interested in providing an opportunity for International Environmental Studies students and faculty to be exposed firsthand to the process through which environmental issues are coming to have specific meaning for policymakers and scientists. Each of the symposia and seminars served to alert faculty to the international implications of their applied or basic research in the agricultural or environmental sciences, and helped students bring abstract understandings into clearer focus.

This latter objective was dramatically achieved through a visit by the first officially-designated group of environmental scientists from The People's Republic of China that visited Rutgers under the auspices of the International Environmental Studies Program in mid-September, 1976. The visit, which was arranged in cooperation with the National Academy of Sciences' Committee on Scholarly Communication with The People's Republic of China, made it possible for our students and faculty to learn firsthand of scientific and policy dimensions of environmental protection in The People's Republic of China.

Another program of great interest to students was a Seminar on International Environmental Policy and Management held in November, 1976. This Seminar, which was sponsored by the International Environmental Studies Program in cooperation with the Department of State's Bureau of Educational and Cultural Affairs and the Washington office of the Institute of International Education, compared national, regional and international approaches to environmental protection. It also considered the relevance of the United States experience in establishing environmental programs in other parts of the world. Discussions in three panels dealt with a number of specific questions relating to the political context of environment as an issue in other countries, the range and effectiveness of strategies for environmental management, and the global relevance of the U.S. experience. Participants in the Seminar included International Environmental Studies curriculum faculty and students and government officials from Asia, Latin America, Africa, and Western Europe concerned with environmental protection, a science writer from a major West German newspaper, a Yugoslav authority on environmental health, and a board member of a leading Swiss conservation organization.

Accomplishments and Prospects

Where are we now? What are the prospects for a curriculum which has used limited short-term Federal support to become fully integrated as an undergraduate major in the land-grant component of a large state university? There is no question as to student interest in and satisfaction with our conceptual and pedagogical approach. Enrollment in the second full year since the curriculum was adopted (1977-78) has more than doubled in every core course, and the number of IES majors has almost tripled in one year.

It would seem that the IES curriculum is attractive to both older transfer students and beginning students because it helps them get the feeling that they are doing something intellectually and practically about the increasingly evident indications of environmental deterioration that they know will affect their lives.

The curriculum was never intended to educate about the environment. It was conceived as an educational vehicle, specific to a particular kind of institution, to point up how the diverse scientific and institutional dimensions of international environmental concern are coalescing, how these concerns can be sorted out, classified, and analyzed, and how undergraduate students can avail themselves of existing course offerings, flexibly organized, to come to personal terms with environmental realities. The curriculum also seeks to provide students with the means to gain personal and intellectual confidence so that they will be able to lead productive and rewarding lives despite uncertainty about the future.

We feel that our graduates will be as employable as those of conventional programs. Here, "interdisciplinary" does not mean "generalist." Close advising assures that every major, very early in his or her program, gets interested in some area of global environmental concern whether it be marine pollution, desertification, endangered species, or environmental epidemiology. We then make sure that the students take sequential discipline courses that will prepare them for graduate work or immediate employment after graduation.

We will have three IES graduates by the end of 1977. Our first graduate is now a graduate student in agricultural economics, with a part-time job in the international operations department of a major agricultural chemicals concern. Another is in the Peace Corps in West Africa; and the third is working on legal approaches to tropical rain forest preservation in Southeast Asia with a leading public interest legal and scientific environmental group. We expect that our future graduates will do just as well.

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ENVIRONMENTAL EDUCATION PROGRAM, SCHOOL OF NATURAL RESOURCES, THE UNIVERSITY OF MICHIGAN

by Bunyan Bryant, James Crowfoot, Paul Nowak,
Ronald Rollet and William Stapp*

Although it didn't go by that name until recently, broad environmental management training has been at home at Ann Arbor, Michigan, as long or longer than anywhere in the country—in the University of Michigan's distinguished School of Natural Resources. That School embraces both the natural and social sciences as they impinge on the study and management of natural resources, organized under six formal graduate programs: Fisheries, Forestry and Wildlife, Landscape Architecture, Resource Ecology, Resource Policy and Administration, Resource Systems Management, and Environmental Education and Outdoor Recreation.

In such an environment it is not surprising that Michigan's master's program in Environmental Education specifically would take a broad approach to the subject, defining it as including "teaching, mass communication, community organizing, or some other strategy or combination of strategies." Under the leadership of Professor William Stapp, probably no other E.E. program has had such world-wide influence on the theory and practice of environmental education today.

What Is Environmental Education?

People have the power to change their environment for better or for worse. How much impact we have on the environment, and what sort of impact, is influenced by our knowledge and skills; by our attitudes and values; and by our political, economic and social systems. All these things, too, can be changed. If environmental quality is to improve, all these things must be changed.

This is the central insight of environmental education. It reflects a growing conviction that improving the environment is not just a matter of studying ecosystems more closely and devising new techniques for managing forests, wildlife, and chemical pollutants.

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It is not enough, for example, that professionals learn how to reduce automobile exhaust emissions. People, young and old, must be able to reach the professionals, to tell them what changes in car design and cost are tolerable. They must have access to political leaders as well, to influence automotive legislation and regulation and to break whatever alliance exists between industry and government against the public. They must be able to build citizen coalitions with enough power to confront, challenge, and change the decisions of government, industry, and environmental professionals. And they must re-examine their own car-buying and car-driving behavior for its environmental implications. If an alternative to the automobile is to be introduced, people must be in a position to help determine the choice of a mass transit system, its political and economic arrangements and its impact on their lifestyles.

If non-professionals are needed to preserve the biophysical environment, they are even more essential to improve the human environment. Conceivably, some temporary amelioration of air and water pollution is possible without attention to individual behavior, social systems, and underlying values—though clearly any long-term solution must incorporate these dimensions. But what about housing, population density, and racial discrimination? The experience of the past decade demonstrates the futility of attacking these crucial environmental crises through purely technocratic strategies. Unless ordinary people become involved in these issues and achieve the technical knowledge and political skills necessary to make their involvement count, the urban environment will only continue to degrade.

The effort to train environmental professionals who are more responsive to the needs and wants of the public is an important improvement. But there is a desperate need to train environmentally effective citizen leaders as well—citizen leaders who can reach wise stands on environmental issues and turn those stands into action.

What are the characteristics of an environmentally effective citizen? First, he or she understands the environmental situation and its origins. This understanding is global, not just local or national. It embraces not only the biophysical environment, but also the cultural and social environment. And it incorporates an analysis of the environmental impact of individual and institutional behavior, personal and societal values, and political and social systems.

Second, the environmentally effective citizen possesses skills useful in the battle for environmental quality. These skills may be ecological or managerial, aimed at improving the environment directly. They may also be psychological, economic, or socio-political, aimed at building new lifestyles and new institutions to replace old ones that degrade our lives and our environment.

Third, environmentally effective citizens are in touch with their own environment and human values. They are motivated by these values to act, individually and collectively, in their work and in their lives, on behalf of people and all living things.

The goal of environmental education is to produce citizens who are environmentally effective and who can help others become environmentally effective—through teaching, mass communication, community organizing, or some other strategy or combination of strategies.

Environmental Education at the University of Michigan

At the University of Michigan, environmental education is centered in the School of Natural Resources (SNR). Administratively it is part of the Environmental Education and Outdoor Recreation Program (EEOR), one of six formal programs in SNR. The other five, whose courses and faculty are readily available to environmental education students, are: Fisheries, Forestry and Wildlife; Landscape Architecture; Resource Ecology; Resource Policy and Administration; and Resource Systems Management. An interdepartmental graduate program in Urban and Regional Planning and an Environmental Simulation Laboratory are also housed in SNR.

As the program names imply, SNR embraces both natural and social sciences, as they are used in the study and management of natural resources. Less applied approaches to ecology may be found in the Departments of Botany, Geography, Geology, and Zoology, all part of the College of Literature, Sciences and the Arts (LS&A). Other units in LS&A of special interest to environmental education students include Economics, Journalism, Political Science, Psychology, Sociology, and Speech. Courses relevant to environmental education are also offered in the College of Engineering and the Schools of Architecture, Business, Education, Law, and Public Health. Environmental education students normally select courses from throughout the University.

The overarching focus of the EEOR program is the interaction between natural resources and human and organizational behavior. The fundamental goal of the program is to help people, groups, and society at large come to grips with this interaction: with the impact of resource issues or personal and social priorities, and with the impact of people and groups in resource decision-making. This goal can be achieved only by helping students integrate traditional natural resources disciplines in the context of developing skills and understandings relevant to the behavior, preferences, and interactions of groups and individuals. The EEOR Program, in other words, endeavors to graduate students who can impart a "natural resources focus" to the thinking of natural resources professionals.

Of the eight faculty in EEOR, three are devoted to outdoor recreation. The five faculty members specifically in environmental education have further divided themselves into three areas of emphasis: Professors Bill Stapp and Paul Nowak in environmental instruction, Professor Ron Rollet in environmental communication, and Professors Bunyan Bryant and Jim Crowfoot in environmental advocacy. Although instruction, communication, and advocacy are not formal departments within SNR and EEOR, course requirements vary among the three options, and students normally select one option when applying but some students pursue a joint program.

How do the three options differ? The simplest explanation is that instruction trains mostly teachers and interpretors, communication trains people in writing and media skills, and advocacy trains mostly social change agents. In a deeper sense, however, all three options are concerned with social change, and their differences are largely a product of the individual interests of the faculty.

Under Professors Stapp and Nowak, the instruction option puts the greatest stress on developing, implementing, and evaluating environmental curricula for primary and secondary schools, and for other education-related organizations. It is designed for students who want to improve the environment by helping young people to clarify their environmental values and obtain new environmental knowledge and skills.

The communication option, directed by Professor Rollet, stresses the use of communications media for environmental understanding and information sharing. It is designed for students who want to improve the environment through the use of communication skills.

The advocacy option, under Professors Bryant and Crowfoot, emphasizes the relationship between environmental quality and social justice, and how to change political institutions through interest-group activism. It is designed for students who want to improve the environment by organizing interest groups to fight for their environmental needs.

The differences among the three options should not be over-emphasized. Instructors often need the skills of communication and organizing; communicators should know how to teach and to organize interest groups; advocates frequently have to instruct or inform their constituencies. All three options are committed to the role of individual citizens, social systems, and values in environmental improvement. Our similarities are more important than our differences, and we work together closely.

Undergraduate Curriculum in Environmental Education

SNR undergraduates may develop a concentration in any of its three program options simply by designing their programs of study in consultation with the appropriate faculty member. The environmental education faculty is enthusiastic about such arrangements, and believes that most students can plan a curriculum that meets their needs within the constraints of SNR requirements. In addition, a formal teaching major in environmental instruction, leading to a teaching certificate, is offered jointly by SNR and the School of Education. All undergraduate programs culminate in a B.S. degree in natural resources. There are presently around 60 undergraduate students concentrating in environmental education in SNR at any one time.

Masters Curriculum in Environmental Education

Roughly 35 graduate students majority in environmental education are enrolled in SNR at any one time. About 25 of these are candidates for the M.S. degree in natural resources; the remaining students are enrolled in the Ph.D. program. Both degrees are offered through the Horace H. Rackham School of Graduate Studies.

Completion of the masters degree normally requires two years (four semesters) of work. Approximately 12 new masters students are admitted each year, four in each program option. Admission is usually for the fall semester (early September), but winter and summer admissions are possible.

The purpose of the masters curriculum in environmental education is to help students become practicing environmental educators—that is, environmental instructors, communicators, or advocates. To assure that some graduates will be able to work with particular constituencies, and that all graduates will be familiar with the perspectives of a wide range of constituencies, the faculty has adopted admission criteria that stress diversity of race, sex, and experience. In this way each student brings to the program a unique background and viewpoint that contributes to the education of other students.

Aside from diversity, masters students normally (but not invariably) enter the program with an undergraduate average of "B" (3.0) or higher. A demonstrated commitment to the field and some real-world experience relevant to environmental education are considered desirable, apart from undergraduate training. In addition, a basic foundation in five disciplines must usually be acquired either before or after entering the program; this consists of one course each in ecology, economics, political science, behavioral science, and research methods. These five courses are not normally counted toward the masters degree.

Because the admission process puts so much emphasis on what the applicant brings to the program that will contribute to the education of other students, applicants are encouraged whenever possible to visit the University and talk with program faculty and students. A 1000-word "statement of intent," required as part of the SNR application, may also be used to describe what the student expects to contribute as well as what he or she expects to gain. In addition, all applicants are welcome to include papers, clippings, or other materials with their applications, to help make the selection process less stereotyped.

Curricula in the three program options share several traits. First, all three options require a minimum of three courses in environmental science—defined broadly to include resource and human ecology; resource and welfare economics; resource policy, management and law, etc. Second, all students take courses in theory and skills pertaining to their area of concentration. Third, all students participate in guided real-world "work-study" experiences as instructors, communicators, or advocates. Fourth, all three program options attempt to generate a rich learning environment of informal seminars, non-credit workshops, films, visiting speakers, and the like, in which students are invited and expected to participate. In addition, SNR requires all masters students to take at least two courses outside SNR.

A masters thesis or practicum is optional in environmental education. The thesis program totals 24 credit-hours of courses and work-study, plus 6 credit-hours of thesis, plus prerequisites that are completed after entering the program if deficiencies exist. The non-thesis program totals 36 credit-hours of courses and work-study, plus prerequisites if deficiencies exist.

The individual program option curricula described below are open to modification. They constitute our current sense of what most students ought to do and are doing.

Environmental instruction. This option is designed to help students acquire greater knowledge and skills in developing, implementing, and evaluating environmental education programs in public and private school systems (K-12), youth organizations, para-schools, and other education-related organizations. Such instructional programs are normally aimed at: assisting the learner in analyzing and clarifying personal values concerning the environment; increasing the learner's interest and sensitivity toward the environment and its problems; and helping the learner develop social skills necessary to effectively activate channels toward change. The instruction option is designed to assist students to acquire the background to implement such programs.

Environmental communication. Persons specializing in this area normally enter the program with competence in at least one of three disciplines: communication skills (writing, photography, graphics, broadcasting, etc.); communication theory (social psychology, systems, media processes, information sciences, etc.); or environmental sciences (ecology, resource policy and economics, etc.). The option attempts to build competence in all three disciplines, to aid the student in becoming a proficient practical communicator on environmental topics. The overall goal of the option is to help people to better understand their environment and to learn to effect change of relevant publics vis-a-vis their environment, and thus contribute to environmental quality through communication.

Environmental advocacy. Advocacy prepares people to live and work as professional change agents in resolving people-environment problems. The goal of environmental advocates is to reduce human and environmental exploitation and encourage more equitable and ecologically sound distributions of resources. To reach this goal the program assists students in developing:

1. expertise on ecological, political, economic and social systems;
2. theory and practice of intentional social change;
3. behavioral skills in planning and implementing change programs;
4. clear values and commitments on environmental, resource and social problems.

To develop such competence, students are expected to participate in multidisciplinary analyses of people-environment interactions and make critical evaluations of the socio-economic system. Students also are expected to develop alternative goals and strategies for organizational, community and societal change and to increase their practical experience through working on socio-environmental change projects.

Doctoral Curriculum in Environmental Education

SNR offers a Ph.D. in natural resources through the Horace H. Rackham School of Graduate Studies. In theory all doctoral students in SNR are "at large" and not associated with a particular program. Nevertheless, each prospective doctoral student must be endorsed by a faculty member who agrees to become that student's advisor; thereafter the student is informally associated with the program in which his or her advisor teaches. Environmental education carries approximately ten doctoral students at a time, accepting only two or three per year for all three program options.

The Ph.D. degree is intended to be research-oriented rather than practice-oriented. That is, it is designed to train scholars, researchers, and college teachers, rather than practitioners, in the areas of environmental instruction, communication, and advocacy. In view of society's more pressing need for practitioners in these areas than for scholars, researchers, and college teachers, the environmental education faculty currently does not intend to expand the doctoral program beyond its present size. Students interested in non-academic careers are urged to consider the masters program instead of the doctorate. Even students with masters degrees in another field may want to consider applying for a second masters instead of a Ph.D.

For those seriously committed to a scholarly career, the University of Michigan offers a supportive environment and superlative facilities. The University is one of the world's major research centers, with excellent libraries, laboratories, and computing equipment. Doctoral students specializing in environmental education are aided in their work by the research capabilities of the SNR faculty, the Institute for Social Research, and other campus units.

At the present time each student's doctoral curriculum is negotiated individually with the student's advisor and doctoral committee. SNR is planning a School-wide doctoral proseminar for the near future, and is considering the possibility of area distribution requirements for doctoral students. But at present there are no across-the-board requirements of any kind imposed by SNR.

The Rackham School requires all Ph.D. students to be in residence at the Ann Arbor campus for at least two semesters of at least eight credit-hours each. In addition, Rackham requires each student to pay minimum fees totaling to two semesters of full-time coursework and three semesters of full-time dissertation research; an additional two semesters of course fees are required for students who enter doctoral programs without a masters degree.

Doctoral students in environmental education typically devote roughly four semesters to coursework, then write their dissertation proposals and form their doctoral committees. Each student's committee oversees that student's preliminary examinations, which cover course mastery and preparation to undertake the proposed dissertation. When the student has passed the preliminary examinations, he or she is recommended for formal degree candidacy; this recommendation must be approved by the SNR Graduate Affairs Committee and by the Rackham School. After the dissertation is completed, an oral defense of the dissertation is the final requirement. The entire process usually takes three to four years.

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SEVEN YEARS IN RETROSPECT: THE INSTITUTE FOR ENVIRONMENTAL STUDIES, UNIVERSITY OF WISCONSIN, MADISON

by Reid A. Bryson*

A reputable commentator said in the 1950's that more ecological understanding had been developed at the University of Wisconsin than at any other institution. Yet like so many faculties, UW professors sensed conventional campus configurations were inadequate to cope with environmental teaching, research, and outreach. Stemming from the discussions of an ad hoc interdisciplinary committee in 1962, by 1970 there was in being at Madison an Institute for Environmental Studies. The UW IES is bigger than a departmental breadbox in that its Director reports like a dean directly to the campus Chancellor, but it is smaller than a school/college elephant in that it is not authorized to grant degrees. So it has had to carve out a unique ecological niche administering major cross-discipline research programs, offering undergraduate courses, sponsoring "committee" graduate degree programs, and developing custom outreach activities. In his "in retrospect" paragraphs, the author suggests formulas for maintaining the health of a multidimensional instrumentality in the face of the centrifugal forces in constant operation on any campus.

The Seed

The history books of America, if they record a beginning of the new environmentalism, will probably identify April 22, 1970, the "Earth Day" of Senator Gaylord Nelson, as the date to remember.

But in Wisconsin, the seed of environmentalism was actually sown sixty years earlier in 1910 when Charles R. Van Hise, then president of the University, wrote, "It seems to me that the universities should take part in the leadership in this movement.... Bringing an appreciation of the importance of conservation to the foreground of human consciousness is a work that cannot be done by one man or one organization in one year, or by many men and many organizations in many years. It is a campaign of education which will extend through generations. But losses have already been so great that the movement should be caried forward as rapidly as possible...."[2]

The words of Van Hise were heeded. The State of Wisconsin developed a strong Department of Natural Resources, and every would-be science or social studies teacher was (and is) required by state law to take

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a course in conservation. The University developed programs and curricula dealing with various resources, such as forests, minerals, and wildlife.[3] Some were devoted to management of renewable resources for sustained yield, and thus were truly conservationist. Some were more concerned with exploitation of resources. There was not, however, an identified, integrated, interdisciplinary program of instruction and research in the science of the man-environment system, that dealt with a sustainable human environment.

But in the late 1950s, the idea of a program more holistic in approach was taking form in the Wisconsin tradition of faculty initiative.

The Roots

About the time that C. P. Snow was writing about "The Two Cultures,"[4] several members of the University of Wisconsin-Madison faculty were independently reaching the conclusion that the disciplines were not adequately combining talents to work on problems that were interdisciplinary in nature. Most significant problems of our time appeared to be of this character: racism, war, poverty, environmental degradation, pollution, and excessive resource use. None seemed to fall within the purview of a single discipline. President Fred Harvey Harrington responded in 1962 by appointing an Interdisciplinary Studies Committee to recommend action. The committee soon became known as the Interdisciplinary Studies Committee on the Future of Man.

The committee members spent the first several years learning how to communicate with one another. It proved somewhat difficult to get an oncologist, an art historian, a political scientist, a meteorologist, and a historian of science to view things from a common perspective.[5] They worked hard and long, however, several hours a week for six years or more. They wrote Faculty Document 279 on the Purposes of the University, which was unanimously adopted by the faculty on December 1, 1969. In it, they said that "ways should be found to allow students and faculty to engage in the interdisciplinary efforts that are implied by the statement of purpose."

During the course of its study, the committee surveyed faculty interest and actual participation in interdisciplinary activities. Nearly all of the 600 or so responses could be neatly categorized--but the dominant category of interdisciplinary collaboration was of two or more professors from different disciplines involved in environmental research. Well over 200 faculty members were involved in various aspects of environmental studies. It was clear that the University had a resource of great potential, if coordination and communication could only bring this resource to bear on the emerging broad environmental problems that were perceived.

During the mid-1960s, another faculty group from a number of disciplines in several colleges was putting together plans for an experimental project in environmental studies. This ad hoc group was known informally as "the Hougas Committee."[6]

In 1964, the Interdisciplinary Studies Committee had apprised the chancellor of their identification of great campus potential in environmental studies that could be developed into a major thrust of scholarship. The chancellor, taking into account these several recommendations and activities, appointed the Madison Campus Special Committee on Environmental Studies in November 1965. This committee, which had representatives appointed by each dean,[7] recommended a year later, in November 1966, that:

1. The University should establish as soon as possible a budgeted unit charged with research, teaching, and service in interdisciplinary environmental studies;

2. The director should report directly to the chancellor, since the program would transcend colleges and disciplines; and

3. Appropriate existing environmental studies activities should be transferred to the new unit in due course.

The time was wrong. Chancellor Robben Fleming--and indeed most of the campus--was absorbed in the student unrest that had just erupted.

During the following year, little happened in the development of the environmental studies concept, but the idea did not die. In 1968 the committee of deans' representatives was replaced by a Faculty Committee on Environmental Studies Advisory to the Chancellor. In December 1969 this committee, known informally as the "Wilson Committee,"[8] made recommendations to Chancellor Edwin Young which were very similar to those made three years earlier, but with more detail: There should be a free-standing unit called the Institute for Environmental Studies, whose director should report directly to the chancellor, which should engage in instruction, research, and service, and to which other related units could be attached.

The recommendations were approved by the chancellor and reported to the Regents in February 1970. A program of interdisciplinary studies of the man-environment system had germinated.

The Flowering

There are hazards in the nurture of new organisms. There had been an Institute for Environmental Studies established for research only, prior to 1970, as an outgrowth of the Hougas Committee activities.[9] The name only was applied to the new free-standing unit. Several members of the Wilson Committee agreed to transfer their research groups and organizations to the new unit upon its establishment, to give it a going program from the beginning.

When the establishment of the Institute was announced and a director appointed by the chancellor, the Marine Studies Center and the Center for Climatic Research immediately affiliated with it, as did the Lake Wingra Study of the Eastern Deciduous Biome of the International Biological Program. The Institute therefore began with strong research programs dealing with the marine (and Great Lakes) ecosystem, the atmospheric subsystem, and parts of the biological subsystem. It also began with serious gaps.

A general grant from the Research Applied to National Needs program of the National Science Foundation, affiliation of a National Aeronautical and Space Agency-supported program in remote sensing of the environment, and grants from the Graduate School and the Rockefeller Foundation made it possible to launch an array of research activities covering the whole man-environment system. Under these initial grants, impetus was given to the Institute's five research centers--the Marine Studies Center, Center for Biotic Systems, Center for Climatic Research, Center for Geographic Analysis, and Center for Human Systems--and two research groups--the Quantitative Ecosystem Modeling Group and the Environmental Monitoring and Data Acquisition Group. A Council of Research Directors, consisting of the directors of each of these subsystem centers and the directors of the Institute, was established to coordinate the research program.

By the fourth anniversary of the Institute the research program had grown up to a budget of about $3,000,000 and involved faculty from more than a score of departments in half a dozen colleges and schools. By this time also, the initial research grants had terminated and most of the research centers had built up strong bases for continued growth and funding. The Center for Human Systems, however, did not flourish as hoped and was temporarily disbanded. The Quantitative Ecosystem Modeling Group also failed to sustain iteslf, but was readily assimilated by the other Centers where modeling has remained a strong component of the research programs.

The research centers have tended to build upon those areas of strength that evolved under the original research grants. For example, the Lake Wingra team in the Center for Biotic Systems developed a sophisticated model of the biological, physical, and chemical relationships in a shallow Madison lake. Portions of this model were later integrated into the Center's study on potential water quality in a proposed reservoir on Wisconsin's Kickapoo River. The model was used to link data on the reservoir's probable sediment loads and nutrient cycles with the predictable behavior of algae and rooted aquatic plant communities. The study concluded that the reservoir would have poor water quality and problems with nuisance plant growth.

Other portions of the Lake Wingra model have become the basis for further research on interactions at the land-water interface; the role of wetlands in nutrient retention and detainment; the role of the littoral zone in lake productivity, decomposition, and nutrient cycling; and the importance of fish in the lake's phosphorous cycle.

Similarly, the Environmental Monitoring and Data Acquisition Group has continued to build upon its early studies in the applications of remote sensing to land and water quality problems. Many techniques for aerial monitoring that were refined by this group are now being used in a long-term study of the environmental impacts of the Columbia I coal-fired power plant on the Wisconsin River. A variety of methods have been used to follow changes in the air, land, water, and associated biotic and economic systems as the plant has been built and come on line.

This project, like the Lake Wingra study and other IES research, has been largely concerned with real problems of statewide, regional and even international scope. On the regional scale, the Institute's research has tackled the issues of inland lake eutrophication; thermal pollution of Great Lakes shorelines; regional movement of air pollution; selection of sites for power plants; tax policies to regulate land use; relationship of climatic trends to river flooding, erosion rates, and fluctuations in Great Lakes water levels; trace metal contamination in harbor sediments; and PCB movements through the Great Lakes food chain.

On the international scale, the Institute has been concerned with global changes in world climate and its effects on food production. The Center for Climatic Research, besides its studies on past climates, is also concerned with building a mathematical model that relates climatic change to crop yields around the world. The same study aims at developing techniques for the long-range forecasting of climate change, and at understanding the relationship between climatic variations and the Earth's rotation.

By focusing on contemporary environmental issues, the Institute's research program has placed strong emphasis on the Wisconsin Idea--the application of university expertise to the real issues and problems of the State. The Institute has fostered strong cooperative links with state planning and resource agencies whenever possible. Part of the Columbia I power plant study, for example, is attempting to establish siting criteria for future Wisconsin power plants. In this effort, researchers are working closely with both the utilities and the Wisconsin Public Service Commission. The remote sensing team has also cooperated with the Department of Natural Resources to set up an aerial photo system for classifying eutrophic lakes. Results of the Marine Studies Center's toxic metal studies in Lake Superior harbors were the basis of recommendations to the Army Corps of Engineers on disposal of harbor dredgings. The outcome of other studies has been the drafting of new resource legislation.

Research program development is relatively easy at the University of Wisconsin. The tradition is that the individual professors choose their own research direction and organize their research as they themselves see fit. All they need to do is find their own money, and the Institute faculty have continued to do so at a fairly constant level. Instructional programs are quite another matter. And it is in this area that the Institute continues to face the greatest obstacles. The instructional program, which the Wilson Committee considered an essential element of the Institute, has developed with agonizing slowness over the past seven years.

Some of the problems have stemmed from the Institute's own unique status —neither a department nor a college, but directly responsible to the chancellor. In 1972 the chancellor did grant departmental status to the instructional program and the Institute submitted a proposal for its own undergraduate degree. However, a major setback occurred when it was belatedly determined that an undergraduate degree could only be granted through a college. This meant that the Institute's proposed degree had to be reworked as a major within the College of Letters and Life Sciences. Currently, the program is in the hands of a faculty committee that is studying the changes necessary to make an undergraduate major acceptable to all.

These organizational difficulties have sometimes been compounded by the inevitable rivalries that tend to occur between disciplines of overlapping interests. Whenever a department, or in this case, an institute, opens a whole new series of courses and programs, it is going to disrupt the established distribution of student enrollment in already existing courses. This is bound to have political ramifications as one department loses enrollment and another gains. Changes in enrollment may also mean that one department loses teaching assistantships while the other gains assistantships and, consequently, improves its ability to support graduate students. If the rise in enrollment is substantial enough, it can even mean that one department justifies new faculty positions while another department remains static. In 1970 the Institute was new; it was associated in many minds with the emotional environmentalism of the period; it promised to grow bigger; and it was preparing to offer eight new courses, a few of which were admittedly faddish or "renegade" courses. Not surprisingly, the Institute's presence was not enthusiastically welcomed by several departments at whose disciplines it nibbled.

This rivalry, and in some cases open hostility, clouded another difficult issue—that of quality control over interdisciplinary courses. Quality control at the University of Wisconsin is exercised by the faculty, by the departmental executive committees in selection of the instructional staff, by the divisional executive committees in the approval of individual courses, by larger faculty groups in their review and approval of curricula, and by academic deans and directors (who are also professors) through their fiscal control.

The original quality control procedures specified by the Wilson Committee proved awkward in that they did not vest control of curriculum and staff in the faculty responsible for the instructional program. This was remedied in January 1972, when the chancellor's office established departmental status for the instructional program of the Institute and appointed an initial executive committee for this "department," with responsibility for staff and curriculum.

Interdisciplinary courses, especially if they are "interdivisional," do not fit well into a system designed for processing course proposals in specific disciplines. An interdivisional conference committee was set up to handle such courses. Some functions within the instructional system involve departmental or individual membership in a division. Where does an interdisciplinary department or scholar fit? This has not yet been resolved.

At the graduate level, the Institute's instructional program has fared somewhat better. Although the Institute does not independently supervise graduate degrees, several committee degree programs are currently affiliated with the Institute. The University has long had a tradition of "committee degrees" wherein a group of five or more faculty members appointed by the dean of the Graduate School acts as a surrogate department to supervise the work of a graduate student who chooses an area of research and study not encompassed by one of the regular departmental degrees. These may be ad hoc committees or standing committees. As of fall 1977, the Institute had approximately 120 graduate students studying under three standing committees. A Water Resources Management master's degree program, supervised by a standing committee, had become affiliated with the Institute in 1973 and has a current enrollment of 72 students. A Land Resources Program under a standing committee was approved by the Regents in 1976 and was also affiliated with the Institute. It has 34 students working toward masters and doctorates. The Environmental Monitoring Program was given approval in 1977 and has 14 masters and doctoral students. The graduate program in Oceanography and Limnology which originally affiliated with the Institute has been subsequently transferred to the College of Engineering. A new degree program in Environmental Systems Analysis is currently under development.

Normally, over a hundred graduate students and forty professors constitute a major graduate department. The Institute has met this criteria, but has not yet been authorized to recommend the granting of degrees. This has been a disappointment.

As mentioned earlier, there are hazards in the nurture of new organisms. Despite the clear success of the research program and the Institute's persistence in the pursuit of its own degree programs, the very existence of the Institute continues to be challenged. In 1974, two faculty divisional committees requested that the University Committee examine the function and purpose of the Institute. Over the course of two years, the committee reviewed the Institute's operations and made a series of recommendations, practically all of which were already in effect.

Despite institutional difficulties, the faculty, largely holding joint appointments with disciplinary departments, has developed and taught a series of courses informally known as "glue" and "crack-filler." These are courses which either tie together materials from several disciplines that bear on interdisciplinary environmental questions, or deal with environmental subjects that lie outside the course offerings of the various disciplines. Enrollments in these undergraduate courses have been steadily rising at the rate of 10 to 15 percent per year. The quality of the courses has also steadily risen as understanding of environmental problems has continually expanded. Despite the fact that the interdisciplinary or interdivisional nature of these courses has often precluded the student from counting them toward required science, social science, or humanities credits, student interest has remained high. The system simply was not designed to a accommodate interdivisional courses and programs, but a great university must find a way ". . . to allow students and faculty to engage in the interdisciplinary efforts that are implied. . . ."

Aside from its formal curriculum, the Institute has also developed avenues for transferring its expertise and research findings to the general public. One such avenue has been a series of weekly two-minute radio programs broadcast five times a week over Wisconsin and regional radio stations. This program is jointly prepared by the Institute and the University of Wisconsin Sea Grant College Program. The Institute and Sea Grant also cooperate in preparing a weekly feature column which is distributed to 45 Wisconsin newspapers and the wire services. Lengthier discussions of research results are contained in 83 technical reports, 33 working papers, and scores of journal articles, proceedings, etc. Up-to-date communication of what is going on in environmental research on the campus is contained in an Environmental Newsletter that goes monthly to nearly a thousand members of the campus community.

In Retrospect

When the "environmental movement" exploded into a national awareness around 1970, many organizations and research programs sprang up around the nation. "Ecology" or "environment" courses were quickly added in both primary and secondary schools. Hundreds of programs were organized in the colleges and universities. These varied from large research programs on trace elements in the environment, to loose groupings of existing courses coordinated by a committee or an individual, to groups of existing departments identified as the "Environmental Studies Institute" or program, to dedication of entire colleges to environmental themes.[10] Many of these programs have now withered a few short years later. Why has the University of Wisconsin program continued to grow and flower?

There are several elements that are, I believe, crucial. First, it takes a large and great university to provide a total community of scholars sufficiently diverse in skills and interests that the "critical mass" of appropriate talent can be assembled to study something as complex and pervasive as the man-environment system without distorting the entire institution.

Second, the program must be organizationally structured in such a way that it is relatively insensitive to fluctuations in priorities. A program which is a subset of a small unit is a prime target for competition with the rest of the unit. In a whole university, minor shifts in many areas can leave a viable program intact.

Third, and probably most important, is the conceptual basis of the program. It must attempt in all undertakings to be truly interdisciplinary and look at the whole system rather than individual parts alone. When this philosophy is incorporated into such practical things as organizing a research project and preparing a grant proposal, it guarantees that a problem will continue to be studied in its entirety whether or not some of its individual parts are politically or academically popular at the time. In this way, the program can retain its integrity and remain a valuable means of pursuing multidimensional problems.

This interdisciplinary approach does not require a totally new set of data, of concepts, or of techniques. It requires a new, quantitative integration of ideas and facts. It requires the development of rigorous generalists to apply this knowledge to the larger system. An environmental studies program based on the fundamental relations of man, technology, resources, and the symptoms of misfunction in these relations will continue to deal with important problems of the world. It cannot be a fad.

NOTES

1. This article is based in part on "The Institute for Environmental Studies: The Growth of an Idea" by Reid A. Bryson which appeared in *A Resourceful University: The University of Wisconsin Madison in its 125th Year*. (Madison: The University of Wisconsin Press; Copyright 1975 by the Regents of the University of Wisconsin), pp. 55-68.

2. This passage may be found in full in Ian Burton and R. W. Kates, eds., *Readings in Resource Management and Conservation* (Chicago: University of Chicago Press, 1960), pp. 179-185.

3. A Department of Wildlife Management was established in 1939 with Aldo Leopold as chairman.

4. C. P. Snow, *The Two Cultures and the Scientific Revolution* (Cambridge, England: Cambridge University Press 1959).

5. The original committee consisted of professors Van R. Potter, James McCamy, James Watrous, Erwin Hiebert, and Reid Bryson. The committee later expanded and changed membership somewhat.

6. The chairman was Associate Dean Robert Hougas of the College of Agriculture, but the committee had membership from several colleges.

7. The chancellor, however, appointed the chairman.

8. The chairman was Joe B. Wilson, Professor of Bacteriology.

9. In this form, from 1966 to 1970, the Institute was directed by Gerard Rohlich, Professor of Civil Engineering. John E. Ross, Professor of Agricultural Journalism, was associate director of this Institute and, in 1970, became associate director of the new Institute for Environmental Studies.

10. A good example is the College of Environmental Sciences on the Green Bay Campus of the University of Wisconsin.

IN THE MIDST OF THE ENERGY-ENVIRONMENT TANGLE: RESOURCE AND ENVIRONMENTAL ECONOMICS AT THE UNIVERSITY OF WYOMING

by Thomas D. Crocker and Allen Vander Meulen, Jr.*

As the title of this case study suggests, few universities are so in the midst of profound energy and environmental policy issues as the University of Wyoming. And few institutions have so focused the teaching and research of its economics faculty on those issues as has the UW. The primary purpose of its resource and environmental economics program is to train graduate students capable of bringing the analytical skills of micro- and macro-economics to bear upon the problems of the Rocky Mountain West. As a spin-off, for undergraduates the program turns the "dismal science" into a highly relevant approach to reducing complex issues to intellectually manageable proportions.

Introduction

An understanding of the resource and environmental economics program at the University of Wyoming requires understanding of the general nature of environmental policy problems and the place that economics can play in their resolution. The Wyoming program is an effort to respond to these problems while maintaining the disciplinary integrity of economics.

In recent years, natural environments that are aesthetic, healthy, and ecologically sound have attracted substantial theoretical attention in the technical economics literature, especially with respect to the implications of economic growth for the time paths of the valuations of these environments.[1] This literature is usually based on a combination of two propositions. First, environments that have remained unsullied by man's activities and artifacts are superior goods. That is, as real incomes increase, the willingness-to-pay for natural environments increases at an even greater rate. Man-made substitutes therefore become progressively less attractive. Second, because of the imperfect reproducibility of natural phenomena, technological change tends to reduce the supply prices for man-made goods relative to the supply prices for natural environments.

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The obvious general conclusion of the above two propositions is that both the relative costs of supplying and the willingnesses to pay for natural environments are going to increase progressively over time because of technological change and growth in disposable consumer incomes. Whether the availability of natural environments will increase or decrease as a result of the countervailing demand and supply forces will depend on the forms and magnitudes assumed by a number of technical economic functions and parameters. Nevertheless, under a wide variety of these forms and magnitudes, it is reasonable to expect that natural environment availability will decline. One major reason is that even though willingness-to-pay for natural environments may progressively increase, market opportunities to convey this willingness are either lacking or very costly to use: the cost of participating in exchanges involving the aesthetic, health, and ecological aspects of natural environments are not trivial. These non-trivial costs may be contrasted with those found in the dominant exchange processes for mechanically and chemically fabricated goods.

For fabricated goods, pecuniary prices tied to explicit contractual obligations serve as the primary means of conveying information about relative economic scarcities and providing the incentives to ameliorate them. If similar information flows and incentives are to be provided for the aesthetic, health, and ecological aspects of natural environments, then either transactions costs for exchange processes involving these environments must be reduced or some non-market, but economically efficient, means of allocation must be adopted. It is not readily apparent that technological or institutional changes can always have sufficient impacts on these transactions costs; that is, it seems unlikely that a market in the aesthetic, health, and ecological aspects of natural environments can be formed to allocate these aspects with socially acceptable degrees of economic efficiency. This implies that a market must often be simulated by public authorities, if the willingness-to-pay for unsullied natural environments is to be adequately accounted for in public and private allocation decisions. In effect, methodologies are required whereby the underlying economic causes of the aesthetic, health, and ecological effects of environmental perturbations, as well as the willingness-to-pay to avoid these perturbations, can be determined. Since it is expected that the economic scarcity of natural environments will increase over time, the policy relevance of institutional and technological adaptations able to convey better information about environmental problems and to provide incentives to correct them, as well as the development of better methodologies to assess the causes and consequences of these problems, will assume progressively greater significance.

Wyoming and the Rocky Mountain West

The issues raised in the previous section are perhaps more visible in the Rocky Mountain West than anywhere else in North America. Economic growth and the natural environment can and frequently do clash in an arid and semi-arid basin and mountainous region that is highly mineralized and is also ecologically, economically, and culturally delicate. The amenities of the region -- great climatic and ecological diversity occurring over short distances, cultural variety, sunshine, expansive vistas, wilderness areas within a couple hours drive from population centers -- draw industry and people. Their presence, however, threatens to degrade the amenities that originally attracted them.

The region's mineral and energy resources, while perhaps its greatest pecuniary asset, also present the greatest potential dangers to its natural environments. What could happen to the quality of the air, the water, and the landscape is clear from what has already happened in Denver, Albuquerque, Rock Springs (Wyoming), and Farmington (New Mexico). Not only are the mineral extraction and processing activities sources of concern, but the populations they bring with them may create even greater environmental and cultural stresses. Rapid city growth brings urban sprawl and its attendant air pollution and concrete landscapes. The surrounding hinterland is marred by second-home developments for people temporarily avoiding the urban sprawl, off-road recreational vehicles moving over land still showing the wheel ruts from wagon trains, and litter, not readily hidden by plants, that degrades much more slowly than in humid regions. All these stresses are threats to the region's fauna, flora, landscapes, and traditional lifestyles. Moreover, the threats are being exercised in a region where Federal agencies control major portions of the land and water supplies. Great private corporations, whose top managerial staffs and shareholders reside elsewhere, also control large land areas. State and local governments, whose effectiveness and representativeness is questionable in some states of the region, must often face these massive concentrations of political and economic power with little information or technical abilities to counter the threats. Decisions that are important to the region are thus, by default, passed to Washington, D. C., and assorted corporate boardrooms. If the values of the non-marketed resources now being altered can be captured, and if the incentive systems faced by developers and their allies can be structured so that they must act as if all costs their activities generate are their own, the region can be financially viable while retaining the essentials of its natural and cultural heritage. The discipline of economics, especially its resource and environmental component, can make substantial contributions to the ultimate accomplishment of these ends.

A Disciplinary Perspective

The preceding sets out in general terms the mission-engendered reasons for the existence of a resource and environmental economic program at the University of Wyoming. It is important to recognize, nevertheless, that the integrated body of analysis which constitutes economics is not the only means for evaluating institutional or technological adaptations, or developing assessment methods, for the social aspirations that cause environmental problems to be perceived. Let us briefly compare the economic concept of value with two major alternative concepts. One cannot advocate the use of economic analysis as the sole means of weighing environmental policy alternatives because the analysis is incapable of capturing all relevant criteria. Some kinds of pleasure and pain, such as distributional justice, are perhaps best kept separate from the mean-minded activities of the marketplace. The market, in the view of many, should not be lugged into every corner of our lives. The logical postulates of economics do not permit it in any case.[2]

The first alternative concept of value, the moral imperatives perspective, starts from the premise that there exist certain fundamental rights -- a healthy environment, equal opportunity, legitimacy of process, autonomy -- that are neither comparable nor reducible. No appeals are made to individual interests and preferences. Instead, collectively held human ideals are invoked. The satisfaction of perceived minimal human needs and the maintenance of fundamental environmental conditions and functions must be met before considering any tradeoffs using value weights derived from individual preferences.[3] Flowing from this perspective is a view of the proper set of actions to take in order to fulfill the fundamental needs, conditions, and functions. For example, if pollution is to be considered a transgression of some specific rule of ethical behavior, then pollution is an immoral activity to be legislated out of existence. Explicit, stringent restrictions on activities that generate pollution are therefore justified. In the more extreme representations of this perspective, pollution is to be eliminated rather than controlled because those who pollute are wrong-doers who should repent.

A second perspective focuses on environmental possiblities rather than human ideals. The laws of natural science, rather than the wishes of human being, are the fundamental sources of value. Relevant examples are the net energy concepts of H. T. Odum (1971), the competitive and altruistic behavior occurring at the level of the cell in Wilson's (1975) sociobiology, and the emphasis in McHarg (1969) on recognition that man is shaped by the environment more than he shapes it.[4]

The traditional economics perspective of the sources of value differs greatly from the previous two perspectives. Economics assumes that whatever the consumer does must be the best thing for him to do, given his knowledge of his circumstances of the moment, since otherwise he would not have done it. The great advantage of the approach is the connection it makes between preferences and actual behavior: the individual's autonomous preferences are revealed by his behavior. Value is thus defined as "to evaluate" rather than as "a value." It is a relation between objects of preference through the intermediary of the individual rather than an end in itself. By viewing value in an active rather than a passive context, the means by which ends can be achieved are given analytical preeminence. The moral properties of the end are not susceptible to evaluation within the framework of economics. In effect, if the process of making the decision to achieve the end is economic, then the decision is economic. Rather than the end justifying the means, it is the means that justify the end. Ends are introduced from outside the discipline. The disciplinary perspective assures that no particular end is dominant to the complete exclusion of other ends.

It must be emphasized that, contrary to the understanding of many non-economists, economics does, in fact, deal with the attainment of non-pecuniary values. Man is considered to be the measure of all things. Thus pollution damages to human health and happiness are really more "economic" than is damage to a real property object. The latter is simply an intermediate means to health and happiness. This, rather than a supposed emphasis upon pecuniary gains and losses, is the essential difference between the economic view and the moral imperative and the environmental possibilities concepts of the sources of value. Certainly, amelioration of the policy problems that environmental phenomena now represent requires kinds of knowledge ranging from the normative and positive through the pragmatic to the prescriptive. However, any decisionmaker acting solely (or even mostly) on the basis of moral imperatives or a comprehensive world view dismisses the overt wishes of the populace as irrelevant to the problem and its treatment. Occasionally this may be necessary because the populace lacks readily accessible information and because circumstances require immediate action. Nevertheless, even though it may not be as arousing as the moral imperatives concept or possess an all-encompassing world view to which everything can be reduced, the economic treatment of environmental issues as mere choices among human expedients does have its place in a democracy. To accomplish something of policy relevance, one must start from man as he is.

The Wyoming Graduate Program

As the name of the subdiscipline suggests, resource and environmental economics has two focuses. One focus is directed at stocks of depletable resources that, once consumed, are not renewable. The other focus is made up of the problem of pollution and the exploitation of renewable resources, where, except for cases of severe abuse, effects are reversible but not without cost. Although the analytical frameworks with which each focus is approached differ somewhat in emphasis, the fundamental issues are the same: (1) description of the consequences of alternative means of allocating resource stocks and flows; (2) consistency of these consequences with conditions of economic efficiency; (3) what the consequences would be if the conditions of economic efficiency were to be brought about; and (4) what policy actions can be taken to approximate more closely the conditions of economic efficiency. In practical terms, these issues translate to a research and teaching emphasis upon: (1) the acquisition of improved understanding of the structure of the resource and environmental issues relevant to the Rocky Mountain region; (2) the design of methodologies capable of generating information about valuations of alternative resource and environmental consequences; and (3) establishment of the likely consequences for the region and nation of alternative management approaches to resource and environmental problems. Problem emphasis is upon the energy-environment interface rather than with energy or the environment alone. Brief descriptions of some of the research currently underway or recently completed under the research arm (The Resource and Environmental Economics Laboratory) of the program gives the flavor of program breadth and direction.

Historically, the aesthetic effects of pullution and landscape alteration have been given no attention in quantitative policy analysis because they have been treated as intangibles; that is, by definition, they are incorporeal and awkward to define and formulate. Strictly interpreted, an intangible thing cannot be measured because no objective unit of measure is known to exist or no acceptable method of measurement is available. Lack of means to measure aesthetic effects encourages those who feel the issue is important to resort to extreme rhetorical advocacy positions. One is reminded of elk with their antlers inextricably tangled who have therefore been reduced to communicating via public snorting. Inability to find any common basis for discussion and resolution of differences usually results in leaving aesthetic supply decisions, by default, to the public bureaucrat. Not infrequently, these decisions have been made without reference to anything other than the bureaucrat's subjective personal notions of aesthetics.

In a recently completed project sponsored by the Electric Power Research Institute, we have shown that at least one aesthetic phenomenon, atmospheric visibility, can be captured in quantitative value terms. The study location was the Four Corners area of the Southwest, a locale where visibility often approximates one hundred miles. Moreover, this superb natural visibility is said by many to enhance the appeal of the arid landscape. Data to infer valuations were obtained by administering questionnaires to approximately one hundred-fifty visitors and residents of the area. In one of the two approaches used for valuation, the respondent was asked whether he would be willing to pay to accept a given dollar amount per month as compensation for the reduced visibility represented in a set of colored photographs of typical local vistas. If the respondent replied negatively, different dollar amounts were quoted until he stated he would be willing to accept the (hypothetical) compensation. In the second approach, inquiries were made about how the individual allocated his leisure time during a summer week and how he would alter this allocation with the reduced visibility depicted in the same photographs used in the first approach. This information, when combined with questionnaire information on daylight leisure time expenditures, allowed us to employ certain theorems from the economic theory of the consumer to infer the compensation the respondent would require to be willing to accept the reduced visibility. Both approaches showed, within the confines of the experiment, that the representative individual would require about seventy dollars a month in order to accept willingly twenty-five mile rather than seventy-five mile visibility.

An ongoing major three-year project, sponsored by the U. S. EPA and being performed in conjunction with the resource economics group at the University of New Mexico, starts from the premise that epidemiology and microeconomic analysis are nonseparable with respect to disease etiology. The two disciplines cannot be disentangled because many of the causes of disease are themselves manifestations of voluntary choices made by the disease sufferer. Rather than following the common biomedical strategy of searching for the smallest single isolable entity to which phenomenal explanations for a disease can be reduced, this project adopts the frame of reference of economics in which joint determination of phenomena is readily allowed and is often logically necessary.[5] Air pollution and some suspected carcinogens are being emphasized. The basic project purpose is to establish the extent, if any, to which economics methods provide estimates about disease etiology different from those obtained in epidemiology.[6] If significant differences are found that are ultimately supported by other investigators, troublesome issues would be raised for many current Federal and State ambient standards.

Because of its energy resources and the attractiveness of its scenic and outdoor recreational opportunities, the State of Wyoming is in a transition phase from what some overwrought observers have termed an "underdeveloped country" to what similarly excitable people see as an American Saudi Arabia.[7] Whatever the emotional wallop of the characterizations one uses, it is evident that much of the State is in the midst of a change from a rural ranching economy and culture (the theme of the State's tourist publicity campaign is "See America as It Was") to an extractive stock resource base with a mining town atmosphere. The process of transition from the ranching economy to the extractive economy can be made more-or-less painful (or beneficial) according to the path of adjustment to be followed. This path of adjustment can be influenced by mineral royalty and severance tax policies, environmental laws and the extent and form of their enforcement, assignments of responsibility for funding measures to lessen the social impacts of large mineral extraction, processing, and transportation facilities, water allocation policies, and other considerations. Research projects now underway that focus upon facets of this transition range from theoretical investigations of the economic factors that cause one adjustment path rather than another to be followed to cost-benefit studies of mining coal and transporting it elsewhere as opposed to mining coal and transporting electricity elsewhere.

The preceding funded research efforts, as well as other similar efforts,[8] involve economics faculty who are not specialists in resource economics (e.g., public finance, regional economics, and agricultural economics), faculty from other disciplines such as statistics, law, ecology, and engineering, and resource economists from other institutions. This infusion of research personnel from outside the immediate environs of the resources program, in addition to the obvious purpose of furthering the research, is also intended to expose graduate students in the program to the perspectives and methods of other disciplines and other resource economics specialists. Exposure to research is not casual impressions obtained from an occasional seminar, but day-to-day substantive involvement in the actual research effort from the proposal writing stage to co-authoring final reports and papers for publication. The purpose of the graduate program is to train individuals capable of doing and/or evaluating research and policy proposals in resource and environmental economics and the disciplinary fields on which it draws. A major premise of the program is that the most effective way to learn how to do research is to do it. The research program is an important teaching tool. For most students, course work is more relevant and exciting if it is useful for a research problem. An attitude is fostered in which the student regards course material in terms of what it contributes to a research problem. Moreover, rather than having exhausted his inventory of research problems upon completion of his dissertation, he will usually possess a fund of problems on which he can continue to draw.

A sequence of four graduate classroom courses in resource and environmental economics complements the teaching accomplished in the research efforts. A master's level course surveys much of the material taught in the three more advanced courses, but with an orientation toward policy issues and measurement problems. Two lecture-oriented courses, which may be taken only after the student has completed a year in graduate micro-and macroeconomic theory, cover the efficiency and equity of alternative organizational means of allocating environmental and natural resources, and the dynamic aspects of resource economics. Among the topics included are the comparative statics of environmental damage and control costs, the economics of uncertainty and of property rights, issues in welfare economics, and economic growth and the environment. As in the research program, a constant effort is made to impress the student with the importance of a symmetrical relation between analytical substance and empirical relevance. A doctoral-level seminar, the topics of which are selected so as to make this symmetry highly prominent, concludes the specialized course sequence.

For doctoral students, a field exam and the dissertation complete the program. Master's students do not take a field examination. They are required to take 26 hours of course work and write a thesis or 30 hours of course work and write a shorter paper.

Outside their resources specialty, students at the doctoral level are required to take at least three courses and a field exam in no less than one of the following areas highly complementary to the resources field: public finance, regional economics, or regulatory economics. The public finance field is by far the most popular field with the current group of doctoral students specializing in resource economics. In addition to a second field and graduate-level micro-and macroeconomic theory courses, all resource students must become proficient in mathematical economics, econometrics, and the history of economic thought. Resources students are strongly urged to complete graduate-level courses in these first two, as well as acquiring an academic background in the mathematical theory of probability, ecological principles, and the law.

Only a program having a relatively small number of students can expect to make the above approach to graduate education workable. In particular, the emphasis upon the symmetrical relation between analytical substance and empirical relevance, as well as the intimate student involvement in the day-to-day research effort, require ready access to the three faculty members specializing in resource economics as well as other economics faculty involved in the resource economics research program. Present plans do not call for having more than twenty resource economics graduate students on campus at any one time. About 60 percent of the twenty-nine students enrolled during the 1977-78 academic year in the economics graduate program are pursuing the resource and environmental economics specialization. All these resource economics students have enrolled since the specialization was initiated in 1975-76, and all are receiving financial support.

Given the multidisciplinary nature of most resource and environmental problems, less emphasis is given in the admissions decision to the applicant's pure economics background than is typical in most graduate economics programs. Although outstanding or very strong performances are required in the intermediate economic theory courses at the undergraduate level, the range of economics courses taken is decidedly secondary in the admissions decision. In fact, a solid performance in a strong analytical course in other resource-relevant disciplines carries more credence than an outstanding performance in some types of undergraduate economics courses. Because of this policy, the program has attracted a number of students who, as undergraduate or graduate students, have majored and performed creditably in biology, physics, law, mathematics, anthropology, statistics, engineering, and political scinece. The perspectives these students bring to resource and environmental economics prod the faculty and fellow students to recall that the methods and world view of economics are nearly always necessary, but only rarely sufficient, for a thorough understanding of resource and environmental problems.

Impact of the Resources and Environmental Program upon the Economics Department

Universities produce many products. We have considered two that complement each other: research and graduate education in resource and environmental economics. Both have grown rapidly. It is useful to consider the costs and benefits of the graduate program in resource economics to undergraduate education and other economics department programs.

The impact of the resources specialization upon the general economics graduate program has clearly been positive. Both graduate enrollment and funding for graduate students have doubled in only two years. The graduate program has become more specialized, but we are confident it has improved in quality. For example, substantially increased research activity in the three other graduate program specializations has accompanied the introduction and growth of the resources specialization.

Undergraduate programs can bear a significant part of the cost of expanding a graduate program. Graduate students demand more faculty time than undergraduates and graduate teaching is certainly more closely related to faculty research interests. Staffing graduate courses plus the needs of graduate faculty for research time have strained department resources and made it more difficult to provide for undergraduate education. These strains have not been without benefits, however.

First, the availability of resource and environmental economics faculty has allowed additional undergraduate courses in this specialization to be offered. The objective is to provide a complete, attractive, and motivating sequence in resource economics, environmental economics, human resource economics, and the law and economics. In addition, outstanding and interested undergraduates are given the opportunity to participate, along with faculty and graduate students, in the research efforts of the resources program.

Second, the strains upon faculty resources have forced the department to try to improve the attractiveness and the coordination of its undergraduate offerings. Undergraduate course offerings have been restructured to permit students more readily to identify specialized course sequences corresponding to their possible career interests. A resource and environmental economics specialization is among the several offered. In addition, a special section of the microeconomic principles course has been established in which resource and environmental problems are used as the vehicle to convey the basic theory and its real applications. These steps have been supplemented by an advertising campaign in the student newspaper emphasizing the applicability of economic knowledge to contemporary problems and career opportunities open to persons with economic training. The effort to improve the undergraduate program has been placed under the direction of a faculty member who serves as an undergraduate departmental ombudsman, student advisor, and chief advocate of the undergraduate program in decisions involving allocations of department resources. All these steps were undertaken in the first semester of the 1976-77 academic year. In the one year that has since passed, the number of majors in economics has increased by 50 percent.

Conclusions

The problems faced by the Rocky Mountain West and the State of Wyoming are at the interface of energy policy and environmental policy. They are large, diverse, and urgent. The purpose of the resource and environmental economics program at the University of Wyoming is to train graduate students capable of bringing the analytical skills of the economist to bear upon these problems. A further purpose is to provide undergraduates with the ability to comprehend the potential contributions and the limitations of economic analysis when applied to these problems. Certainly, the State of Wyoming and the surrounding region make it easy to avoid giving students the impression of ivory-tower web-spinning. Simultaneously, the interrelatedness of the region's problems makes highly visible the necessity and usefulness of abstraction and careful, logical analysis serving to reduce the complexity to intellectually manageable proportions.

FOOTNOTES

1. See, for example, Fisher and Krutilla (1974).

2. Among other postulates is one stating that the income distribution generating any particular economic outcome is a matter of indifference. When applied to the non-market relations that characterize most environmental problems, economic analysis allows one to make unambiguous statements about economic efficiency. However, if the restrictive assumptions and special definitions of the analysis are dropped to allow other criteria to be encompassed, it then becomes impossible to make unambiguous statements about economic efficiency.

3. This is the position adopted by Tribe (1973).

4. Occasional examples of McHarg's (1969) perspective can occasionally be found in the economics literature. See, for example, Gintis (1972) and Scitovsky (1975), where it is argued that preferences determine civilization (the economic view), but also that civilization determines preferences.

5. One now occasionally sees attacks from within biomedicine upon its reductionist predilections. See, for example, Syme and Berkman (1976) and Engel (1977).

6. A second major objective of this project is to establish the economic value of the health risks due to air pollution, with particular emphasis upon photochemical oxidants.

7. The pressures many people of the State feel is perhaps conveyed by imagining what one's response would be to a casual remark one of the authors (Crocker) actually heard an unnamed medium-grade ERDA official from Washington, D.C. make: "Wyoming must sacrifice itself for the good of the country."

8. Other recent funded research efforts involve or have involved the valuation of wildlife populations in Wyoming, the economic efficiency properties of the temporal price paths of natural resource stocks, the impact of atmospheric pollution upon labor productivity, decision criteria for nuclear waste disposal, and a cost-benefit analysis of proposed USEPA regulations to control the use of fluorocarbons.

9. Unless carefully controlled, the fostering of this attitude can be dangerous for the first-year student who must master a broad range of fundamental analytical material that can readily appear

(mistakenly) to him to be far removed from the research effort. For this reason, we try to make relatively few research demands upon the first-year student.

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WILDERNESS INSTITUTE, SCHOOL OF FORESTRY, UNIVERSITY OF MONTANA

by Tom Daubert*

While some environmental studies programs are extremely broad in scope, others are quite specialized. One of the latter is the Wilderness Institute in the University of Montana's distinguished School of Forestry. Born in the land use allocation controversies common in the West under the federal Wilderness Act of 1964, the Institute seeks to develop professional wildlands management expertise and public understanding of a wilderness ethic. Institute activities include sponsoring a block fall quarter of instruction in "Wilderness and Civilization," research projects involving graduate students in a variety of disciplines, adult education conferences and workshops, summer field studies, and a computerized center of non-biased information on wildlands issues. The Institute's funding track record is unique: out of 20 proposals submitted to granting agencies, 17 have been accepted--a tribute to a unique role in a unique aspect of America's growing ecological conscience.

The Wilderness Institute was founded in May, 1974 at the Forestry School of the University of Montana in Missoula. Initially, it was an experimental response local, regional, and national needs identified by a group of conservationists, land agency personnel and wilderness-related educators. At that time, federal agencies were making allocation and management decisions for our nation's last remaining roadless acres. Simultaneously, this decision making was the subject of increasing controversy, and the wildland planning process was characterized more and more by a breakdown in communication and trust among divergent citizens' groups and land management agencies. The founders of the Wilderness Institute hoped, in part, to mediate these conflicts through the operation of a clearinghouse for non-biased information about wildlands--in essence, they hoped to further the aims and spirit of the Wilderness Act of 1964.

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From the outset, the Institute has sought to serve four primary functions:

1. to promote the development and dissemination of factual information about wilderness and similar resources;
2. to assist the public, agencies, universities, and private landowners in allocating and managing such resources;
3. to develop professional expertise for application to wilderness-related problems; and
4. to promote research and public education concerning wilderness and a wilderness ethic.

The coalition of educators, wildland management professionals, and conservationists who have served as advisors to the Institute is unique, as is the outpour of student and citizen volunteer work which has charged and propelled the organization since its infancy. While its programs are still uniquely interdisciplinary for the University of Montana, the Institute is no longer intrinsically experimental. In fall of 1976, the regents of the state's system of higher education recognized the Wilderness Institute as a formal entity within UM's School of Forestry.

The work of the Institute is administratively divided into five program areas, which overlap in scope and function. A summary of past and present achievements within each of these areas provides an introduction to the Institute's activities.

Undergraduate Education

A special fall-quarter offering titled "Wilderness and Civilization" has attracted considerable interest nationwide. The 17-credit program combines courses in forestry, English, philosophy and humanities to acquaint students of diverse disciplines with the philosophical and practical aspects of mankind's relationship to wildlands. It begins with a two-week back-pack trip in a nearby roadless area, during which students and faculty share a common wilderness experience and learn first-hand of major wilderness management problems and issues. Upon returning to campus, they begin nine weeks of intensive reading, discussion, and reflection. Two forestry courses concentrate on the fundamentals of ecology and the role of wildlands within larger ecosystems; they also deal with the complexities, both scientific and political, of wilderness allocation and management. Work in the humanities centers on such concerns as "human chauvinism," "the managerial mind," cultural attitudes toward wildland as expressed in American literature, the role of wilderness in a sensitive and workable land-human ethic, and the future for human participation in the natural world.

The program also requires each student to keep a journal throughout the quarter, and to complete an independent project which has practical bearing on some aspect of wildlands. One such project in fall, 1976, for example, involved the development of a boundary and policy guideline proposal for a wilderness area on tribal lands of the Flathead Reservation.

"Wilderness and Civilization" is designed to be academically demanding--the reading load alone generally precipitates a minor student revolt midway through the quarter. The program attempts to integrate immediate, direct knowledge of wildlands--represented by the field trip--with the more theoretical, academic concerns pursued in readings and class discussions. Because of the diverse backgrounds of students and the interdisciplinary array of faculty and guest lecturers, the focus on wilderness is approached from numerous angles, and student evaluations consistently attest to the success of this thematically unified structure. "Wilderness and Civilization" is a thorough and consuming learning experience which makes a lasting impression on the educations of all involved.

Research and Graduate Education

The Wilderness Institute routinely proposes, sponsors, and/or conducts major research projects relating to wilderness and wildland planning. Often, these projects coincide with the academic programs of undergraduate and graduate students in diverse disciplines, from forestry to philosophy. For example, the Institute conducted two projects funded by the Bureau of Land Management, one studying the backcountry impacts of off-road vehicles, the other involving the development and implementation of public participation in land planning for a BLM Primitive Area in Idaho. At this writing, the Institute is conducting research and development for a public television documentary series on "Wilderness Women," a historic look at pioneer women funded by the National Endowment for the Humanities. It is also conducting research on the role of wildlands not classified as wilderness in providing recreational opportunities. Studies of types and amounts of recreational use are now underway in such areas near Missoula.

Continuing and Public Education

While non-students participate in all the Institute's programs to varying degrees, the bulk of the Wilderness Institute's work with the general public falls into this category. Toward its goal of public education concerning land planning and wilderness values, the Institute periodically sponsors large-scale conferences and symposia on wildland issues of topical concern.

A three-day conference held in November, 1975, "The Right to Remain Wild, A Public Choice," dealt with the philosophical and practical importance of wildlands to humans, and established methods of wildland evaluation and public participation in land-use planning. In attendance were land management and conservation leaders from across the country, along with students and citizens from the Pacific Northwest. Most guest speakers were land agency personnel and conservation activists, but the conference also featured poets John Haines and Pulitzer Prize-winner Gary Snyder, who contributed to the proceedings a practised voice of eloquent sensitivity--a perspective and style generally absent from such academic seminars. The result was a conference which transcended the surface complexities of wildland conflicts, which went beyond discussion of mere content issues such as the economic benefits of development versus those of wilderness. Instead, some of the deeper problems facing us in our relationship to wilderness--conflicts between abstract values such as solitude and comfort--found expression to which all--from miner to purist hiker--could relate. Participants drew up a list of current problems relative to wildland planning, problems which act as obstacles to successful resolution of common wildland controversies, and although those in attendance failed to agree on potential solutions, a useful dialogue had begun which continues today.

A year later, the Institute published the proceedings from "The Right to Remain Wild" conference. Edited from over 50 hours of taped transcript, the 161-page document was distributed nationwide to those who had attended and to those on the Institute's mailing list. A favorable review of the proceedings appeared in a June, 1977 issue of Backpacker; since then, a worldwide demand for copies has overwhelmed the Institute's small staff and resources, pointing to a growing interest on the part of recreationists in the technicalities of wildland planning, as well as to the Wilderness Institute's ever-growing role in the area of public education.

Other such conferences are planned for the future; in the meantime, the Institute continues to hold small-scale symposia and seminars which are open to the public. During the winter of 1977, for example, it sponsored an eight-week seminar on techniques of minimizing one's impact when camping in backcountry.

Summer Field Studies

Each summer, student and citizen volunteers, trained and supervised by the Wilderness Institute, conduct research in roadless and undeveloped areas throughout the northwest. Because the areas selected for study usually have not yet been allocated, participants collect data which later supplements information used in management decision making.

Beginning in a spring-quarter seminar, study teams of 3-5 members each assemble existing information on their respective areas from a variety of federal, state and private sources. In the course of the summer, they spend a minimum of thirty days in the backcountry, conducting, for example, natural resource inventories and recreational use studies; code-a-site, a Forest Service method for monitoring trail and campsite deterioration, is one of the techniques commonly employed.

Twenty-two students participated in the field studies program during the summer of 1977. Each of three study teams concentrated on a roadless area; a third reviewed all Montana's rivers, selecting six for on-site study of their potential for inclusion in the National Wild and Scenic Rivers system. A fourth study team monitored the Forest Service's Roadless Area Review and Evaluation II (RARE II) in Region I.

During the fall and winter, each study team's final report is prepared, reviewed, printed, and distributed to interested parties. In the past, these reports have been used by agencies in management decision making, by conservationists in advocacy work, and by Congress in considering Wilderness proposals.

Information Center

Each program thus far outlines involves, to some extent, the production of written material--reports, maps, project papers, conference and seminar proceedings--concerning wilderness areas and issues. In this way, four of the Institute's programs serve as a basis for its fifth one, the Information Center.

The Information Center is an information bank for individuals and groups interested in wildland planning, particularly in the northern Rockies. Institute staff supply information in response to requests from all over the country, and provide various kinds of data about wildland resources to agencies, politicians, conservation groups, researchers, and interested citizens. In addition, Institute staff frequently conduct information searches as a service to members of the wilderness-oriented community, and are formally available for contract work on projects (such as the BLM studies) which require considerable time.

The Information Center also houses an extensive filing system containing an abundance of information--mostly concerning wildlands within USFS Region I. Visitors are free to browse through these files, and most materials can be borrowed for up to two weeks. Other materials available at the Institute include the following:

1. a newsletter, "Words on Wilderness," which updates those on our mailing list about on-going projects;

2. reprints of a varied selection of wilderness-related articles and field study reports;

3. a prepared packet of information, with maps, about roadless areas included in pending legislation;

4. the Wilderness Institute Roadless Area File (WIRF), a computerized list of all USFS Region I roadless areas, with an updated account of each area's size, location, and status within the classification process; and

5. a catalogued collection of color slides, including on-site shots of 19 backcountry and Wilderness areas in Montana and Idaho, with sub-sections on flora, forest impact, general impact, history, people and wildlife (available on loan).

The Wilderness Institute maintains its work in the five above-outlined program areas by virtue of its symbiotic relationship with the University of Montana. Each year the Institute's presence attracts a significant number of new students interested in wilderness-related fields, while at the same time, the structure of a university environment facilitates the Institute's productivity.

Much of the work accomplished to date has been done by student volunteers who want to learn more about, and gain experience with, wildland issues and land-use planning. Those interested in working on major projects relating to wilderness may arrange to do so for academic credit within various independent study options offered by the university. In addition, students with work/study (a type of financial aid) status are eligible for a limited number of part-time, salaried positions.

Student employees and volunteers work under the guidance of the Institute's Executive and Assistant Directors, Dr. Robert R. Ream and Dale Harris, respectively, and Field Studies Coordinator, Ken Wall. An Executive Committee and Board of Advisors, composed of distinguished professionals, educators and citizens within the wilderness-oriented community, also meet periodically to oversee the Institute's activities.

General funding for the Wilderness Institute, which comes from a wide variety of sources, has included some support from the School of Forestry, University of Montana. The majority, however, has come from outside grants and contracts awarded by the Associated Students of the University of Montana, and conservation groups like the Wilderness Society, the Sierra Club, and the Montana Wilderness Association. Grants for individual projects have come from the Montana Committee for the Humanities, the National Endowment for the Humanities, and the Confederated Salish and Kootenai Tribes. Contracts with BLM have financed three research projects.

One of the most exciting aspects of the Institute--due probably to the timeliness of its work--concerns the success of its fund-raising history. Of twenty proposals submitted to regional and national funding sources over the past three years, only three have been turned down. Nevertheless, a significant segment of the Institute's work depends wholly on small contributions from individuals, and donations--though not actively sought--are happily accepted.

By definition and philosophy, the Wilderness Institute is unique: thirteen years after the passage of the Wilderness Act, it is one of the few existing public organizations which takes a non-advocacy position on specific wilderness issues, and which works full-time toward the organization and distribution of information and ideas central to the public fulfillment of that Act. The Institute is unique in being a place where scientists and humanists work together in exploration—both philosophical and practical—of wilderness concerns. And it is one of the few places where students work side-by-side with professionals, both within and outside the academic environment. Perhaps it is because of these unique characteristics that the Wilderness Institute, in its few short years, has met with such success.

INTEGRATIVE ENVIRONMENTAL STUDIES: IOWA STATE UNIVERSITY'S ENVIRONMENTAL STUDIES PROGRAM

by Craig B. Davis*

If you're thinking about establishing an environmental studies program in a large university and you're wondering what can go wrong—and right—this case study is a fine guide. The author's three strategies: (1) form a steering group that is representative yet "small enough to get some work done," (2) identify individuals "committed to interdisciplinary activity," and willing to run the attendant risks, (3) place your program objectives "in priority order and focus on them one at a time." What has emerged at Iowa State from this formula is a well-established undergraduate environmental studies major, a growing extension effort, and a projected graduate program, each involving a combination of interdisciplinary integration, disciplinary depth, and problem-solving. As Dr. Davis believes: "In-depth expertise is the bottom line in any interdisciplinary problem-solving effort; without such expertise, integrative problem-solving becomes a superficial exercise." The Iowa State program operates with a two-person permanent faculty and a large pool of cooperating professors participating under "memoranda of agreement."

Our environment and the problems besetting it today are extremely complex, having biophysical, technological, social, and cultural aspects. One person cannot hope to master the entirety of these problems and single disciplines are similarly limited. Cooperative, integrated, interdisciplinary efforts are needed. The Environmental Studies Program at Iowa State University was established to organize, facilitate and direct interdisciplinary environmental projects, research, and education programs aimed at solving these complex problems.

HISTORY

The pre-environmental studies years - 1969-1973

The seeds of the I.S.U. Environmental Studies Program were sown during the general awakening of environmental consciousness in the late 1960's. In the fall of 1969, an informal group of faculty, staff, and students met to compare and discuss environmental interests and consider possibilities for establishing a multidisciplinary environmental program at

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Iowa State. At its second meeting this informal group appointed a steering committee to organize and coordinate its efforts. Membership on the steering committee was awarded to every department or other University administrative unit involved in the parent environmental group. This steering committee was dubbed the "Environtology Steering Committee" and the larger group became known as the Environtology Group. Environtology was defined as "that study which seeks to improve the environment in order to preserve the health of man and other organisms and the quality of living." The Environtology Steering Committee became an official University Council in April 1970, was provided with office space and a secretary, and was renamed the "Environtology Council".

From the beginning, the Environtology Group and Council placed a strong emphasis on problem-focused activity. Early efforts were directed toward developing multidisciplinary research on environmental problems, cooperating with local and State agencies in seeking resolutions to pressing environmental problems, and identifying and inventorying existing University courses that had an environmental-problem focus.

Also from the beginning, the activities of the Environtology Group and Council had a very strong multidisciplinary, rather than interdisciplinary, orientation. Iowa State University is known for its disciplinary excellence, especially in the sciences and engineering. Today, these disciplinary strengths form a strong base on which our interdisciplinary program has been built. During the first three years of the Environtology Group, however, these strong disciplinary orientations were a hindrance to the development of truly-interdisciplinary, porblem-focused projects and programs. Small, short-term interdisciplinary projects were completed, but no sustained commitments to intensive, interdisciplinary research projects or long-term integrative educational programs developed.

On the research side, there was a lot of talk about major interdisciplinary reserach efforts and the Council was successful in establishing a cooperative laboratory facility for environmental research. This lab, the Central Laboratory for University Environmental Studies, contains some of the most sophisticated analytical equipment available. A few individuals have used it for their disciplinary research but it has not resulted in the development of any perceptible cooperative inter- or even multidisciplinary research on environmental problems.

On the education side, the Council organized a very successful teaching in 1970, completed an inventory of disciplinary courses dealing with environmental topics, and even won University approval for a new interdisciplinary course designed to focus on broad environmental issues. These were short-term gains. An Environtology Curriculum Committee, with representation from "relevant" departments, spent two years attempting to develop an integrative, interdisciplinary environmental curriculum. They were totally unsuccessful. Three lessons had to be learned before truly interdisciplinary environmental projects and programs could be developed and sustained.

Lesson #1. The size of the Environtology Council had to be reduced and its representative structure had to be altered.

The large size of the original Environtology Council, more than thirty members, made it cumbersome and ineffective. During the summer of 1970, three organizational modifications were made to remedy this situation. First, the Council Chairman was empowered to appoint an Executive Committee that would assume responsibility for determining the direction of future Environtology activities. Second, the University adminstration approved a new faculty position as Executive Secretary to the Environtology Council. This position was filled in the fall of 1970, the Executive Secretary assuming responsibility for the day-to-day operation of environtology projects and of the Environtology office. And third, the Council appointed a reorganization committee and charged it with developing an organization plan that would provide for a Council with representation "across the board"[1] but "small enough to get some work done."[1]

The recommendations from the reorganization committee were approved by the University adminstration in April and implemented on July 1, 1971. The new organizational plan replaced the previous departmental/disciplinary representation with an intercollegiate design. Council representatives became responsible to the Dean rather than to an assortment of department chairpersons. This reduced the number of "bosses" considerably and at least partially freed the Environtology Council from the control of non-supportive, sometimes hostile departmental representatives. With the exception of minor alterations, mentioned below, this organization plan is still used today. It has improved the efficiency and the productivity of the Council but has not completely solved the problem of developing sustainable environmental projects and programs. The second and third lessons took longer to learn.

Lesson #2. Our criteria for selecting members of our committees had to be changed.

In attempting to accomplish its objectives, the Council has consistently delegated responsibility to specialized committees and task forces. As noted above, success was achieved where project goals called for short-term activities that did not require significant alteration of the traditional emphasis on disciplinary activity. No consensus could be reached on plans that called for the establishment of long-term interdisciplinary efforts.

The reward structure at Iowa State, as at most research universities, favors disciplinary activity. This is the path of "least resistance" toward achieving tenure, promotion, and increases in salary. Most faculty members are trained to operate within a single discipline. We can do this easily, almost without effort. Why take risks? Why exert energy and spend time on interdisciplinary activity where the rules are vague or unknown and the professional rewards are, at best, uncertain? It is not surprising that even well-intentioned disciplinarians are often reluctant to invest too much time and energy in activities that seem, on traditional grounds, to be less productive and less rewarding than are disciplinary activities.

Luckily, there are a few dedicated souls who are willing to "go the hard way". Herein lies Lesson #2. Committees charged with developing long-term interdisciplinary programs should be composed of persons committed to the value of interdisciplinary activity. Committee members selected solely on the basis of disciplinary or departmental affiliation will, too often, be primarily interested in protecting supposed disciplinary or departmental prerogatives. On the other hand, committee members selected because of their commitment to the concept of interdisciplinary study are more likely to be able and willing to rise above such protectiveness.

With this in mind, the ineffective Environtology Curriculum Committee (composed of departmental representatives) was replaced in the fall of 1972 by a new committee of four faculty members dedicated to developing an interdisciplinary environmental curriculum. These men---a biologist, a physicist, an economist, and an engineer---produced a proposal for a three-quarter sequence of integrative, interdisciplinary courses. Their course outlines served as the basis for our present introductory environmental studies course sequence: Mankind and the Environment.

> *Lesson #3. The Council had to place its program objectives in priority order and focus on them one at a time.*

Environmental interests within the original Environtology Group varied considerably. For three years, energy and time was spent on ideas and projects aimed in many different directions: research, extension, graduate education, undergraduate education, etc. In the fall of 1973 the Council decided to give the development of an undergraduate environmental studies program priority consideration.

The Environmental Studies Program - 1973 to the present

Undergraduate Program - With its lessons learned, the Council set out to develop an integrative, interdisciplinary environmental studies program. This involved two steps: (1) the creation of integrative interdisciplinary courses, and (2) the development of a full, environmental curriculum. Coursework developed included the three-quarter introductory sequence, Mankind and the Environment, noted above. We also initiated an intensive, senior-level course on environmental impact assessment and regular interdisciplinary environmental studies seminars. These courses and seminars provided us with a core of integrative, interdisciplinary offerings. In January 1974, the Council appointed a new curriculum committee and charged it with developing a proposal for a 45-credit undergraduate curriculum in environmental studies. Their proposed "Environmental Studies Program" was approved in October 1974. The first student to complete the Program graduated in the spring of 1975.

In April of 1974, with the development of the Environmental Studies Program well underway, the Environtology Council changed its name to the Council on Environmental Studies. At the same time, in view of the increasing administrative responsibilities being developed for the Executive Secretary, this position was upgraded to Coordinator of Environmental Studies. A later (September 1977) reorganization plan designated the Coordinator as the Program Executive Officer of the Environmental Studies Program. This placed the Coordinator on an administrative par with department chairpersons.

In May of 1976, the Council proposed that the Environmental Studies Program be given major status. This proposal, noting that the Program was designed to supplement disciplinary majors, stipulated that environmental studies be used only as a second major. After a full year of intensive study, the University Curriculum Committee approved the proposed environmental studies major. At this writing, mechanisms are being developed for administering the major in each of the undergraduate colleges. Our first majors should graduate in March of May of 1978.

Extension program - During the 1974-75 academic year the Council initiated a trial extension program. An adjunct assistant professor was hired to offer a five-credit interdisciplinary environmental course at five locations in Iowa. Enrollment in this course was so high and the student evaluations were so positive that the administration agreed to fund the position on a permanent basis.

Graduate program - In October 1974, the Council appointed a graduate steering committee to prepare recommendations for a graduate program in Environmental Studies. The development of a graduate program is desirable, but has a low priority at this time. A proposal from this steering committee is now being reviewed by the Council.

Summary

Today Iowa State has a well-established undergraduate environmental studies program which may be taken as a major, a growing extension effort, and a potential graduate program. These programs are all problem-focused. In their development and organization we have attempted to incorporate a combination of interdisciplinary integration and disciplinary depth. All this is being done with one eye on the desires and goals of our students and the other eye on the increasing demands presented by a deteriorating environment.

ADMINISTRATION

The administrative structure of the Environmental Studies Program is illustrated in Figure 1.

Council on Environmental Studies[2]

Policy decisions are the responsibility of the Council on Environmental Studies. This Council consists of ten members, broadly representing the various sectors of the campus community. Representation includes each of the six colleges, University Extension, the Ames Laboratory-ERDA, the Government of the Student Body, and the Coordinator of Environmental Studies.

Appointment: By the Vice President for Academic Affairs.

Tenure: Coordinator of Environmental Studies - permanent
GSB representative - One year, renewable
All other members - Three years, renewable

Council Chairperson: One member of the Council is appointed by the Vice President for Academic Affairs to serve as Council Chairperson. The Chairperson serves a term not to exceed three years. Duties of the Council Chairperson are to call and preside over meetings of the Council on Environmental Studies.

Any proposals adopted by the Council are forwarded to the Coordinator for implementation. The Council may organize and appoint committees to assist it in the achievement of its goals. These committees serve in an advisory status and may include both on- and off-campus personnel. Membership on committees in voluntary and, in the case of ISU faculty, is with the permission of the individual's Department Chairperson and College Dean.

Members of the Council on Environmental Studies provide liaison between the Environmental Studies Program and the members of their constituencies (College, GSB, Ames Laboratory). Each member is responsible for working with the Coordinator on Council matters directly or indirectly affecting his/her constituency.

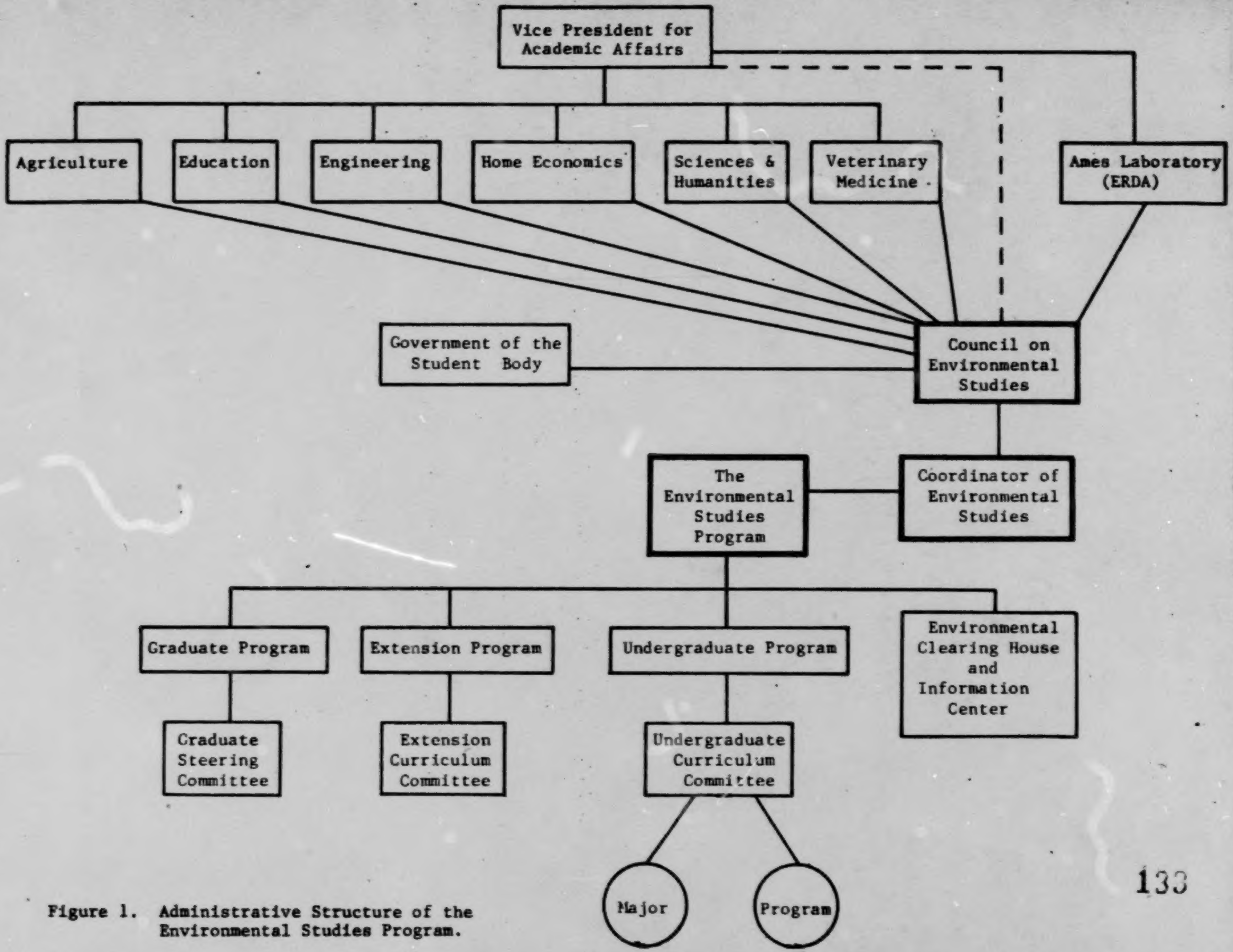
Vice President for Academic Affairs
Agriculture
Education
Engineering
Home Economics
Sciences & Humanities
Veterinary Medicine
Ames Laboratory (ERDA)
Government of the Student Body
Council on Environmental Studies
The Environmental Studies Program
Coordinator of Environmental Studies
Graduate Program
Extension Program
Undergraduate Program
Environmental Clearing House and Information Center
Graduate Steering Committee
Extension Curriculum Committee
Undergraduate Curriculum Committee
Major
Program

Figure 1. Administrative Structure of the Environmental Studies Program.

The Coordinator of Environmental Studies[3]

The Coordinator of Environmental Studies serves as the Program Executive Officer for the Environmental Studies Program. The coordinator:

1. designs, organizes, integrates, and submits to the Council proposals for programs and activities designed to achieve the goals set forth for the Environmental Studies Program;
2. administers all programs approved by the Council;
3. directs all activities of the Environmental Studies office and its staff, and
4. serves as liaison between the Environmental Studies Program and the University administration, Department Executive Officers (Chairpersons) and campus committees, councils and organizations.

Budget

State funds are budgeted for the salaries of the full-time staff and for the Environmental Studies Program operating budget. "Soft money" is used only for special programs and projects.

Staff (full-time)

1. Coordinator of Environmental Studies - Ph.D.
   75 percent Environmental Studies; 25 percent Disciplinary department
2. Environmental Extension Specialist - Ph.D.
   100 percent Environmental Studies
3. Secretary

Staff (cooperating faculty)

Faculty members involved in our teaching program come from disciplinary departments. Four mechanisms are employed to insure that proper credit is awarded to these cooperating faculty members and their home departments:

1. Memorandum of Agreement: This is a mini-contract that formalizes the details of the cooperative arrangement. It is signed by the faculty member, the Chairperson of the home department, the Dean of the home college, and the Coordinator of Environmental Studies.

2. Teaching Load Credit: Every effort is made to assure that participation in the Environmental Studies Program is included in each cooperating faculty member's "regular" teaching load. Participation on an "overload" basis is avoided.

3. Released-time: Each college has "emergency staffing" funds available to assist understaffed departments that are participating in interdisciplinary programs. These funds are treated essentially as "released-time" funds.

4. Student Credit Hours: The home department of a cooperating faculty member receives credit for a portion of the students in the class. The home department of a faculty member giving one-fifth of the lectures in an environmental studies course will receive credit for teaching one-fifth of the students in that course.

This system provides us with both stability and flexibility. Each of our interdisciplinary courses is coordinated on a semi-permanent basis by a single cooperating faculty member. Other participants in these courses are asked for short-term commitments (1 or 2 years). There is no shortage of talented faculty willing to make such short-term commitments. Thus each year we are able to reassess our needs and goals and acquire the faculty expertise desired for that year. This makes for a program that is constantly adjusting and constantly up-to-date.

ENVIRONMENTAL STUDIES PROGRAM

Undergraduate Program

Objectives:

The principal objective of our undergraduate curriculum is the development of effective environmental problem solvers. Although many students enroll in our undergraduate courses in order to broaden their liberal education, the main thrust of the undergraduate curriculum is the preparation of students for various types of environmental careers— environmental law, management, impact analysis, planning, design, reserach, communications, and education. We believe that environmental problems require immediate attention. Thus, while our curriculum has an "awareness" component aimed at increasing the student's appreciation for the beauty and integrity of the environment, most of our efforts are directed toward providing students with concepts, insights, skills and techniques that should enable them to have an immediate impact in their chosen environmental careers.

With the production of knowledgeable and effective environmental professionals as our prime goal, our specific objectives are:

1. To insure that our students develop, through integrative coursework, projects, and internships, sufficient breadth of perspective to be able to identify and seek expertise on the major components of environmental problems. It is the lack of such perspective that all too often results in incomplete, single-minded approaches to the analysis and solution of environmental problems.

2. To insure that our students also develop, through disciplinary coursework, sufficient depth of understanding in at least one aspect of environmental problems to be able to contribute productively to the cooperative problem-solving process. In-depth expertise is the "bottom line" in any interdisciplinary problem-solving effort. Without such expertise, integrative problem solving becomes a superficial exercise.

3. To focus on the amplify the individual talents of our students and allow these students to pursue their own unique environmental interests and goals.

Curriculum

The undergraduate curriculum consists of forty-five quarter hours of coursework. Two important features of this curriculum are its emphasis on integration and its student-oriented flexibility. Integration is provided by a fifteen-credit core of interdisciplinary courses that are required of all environmental studies students.

Sophomore year

-University Studies 221. Mankind and the Environment: Concepts. (Cr. 3) And introduction to environmental studies, with emphasis on understanding the complexity of the environment and of environmental problems. Major topics include principles of ecology, resource economics, and entropy.

-University Studies 222. Mankind and the Environment: Resources, Energy and Pollution. (Cr. 3) Prereq: 221. An investigation of environmental problems associated with the production and utilization of resources and energy. Field trips.

-University Studies 223. Mankind and the Environment: Population and Food—Policies and Values. (Cr. 3) Prereq: 221. An investigation of world population and food problems and of various personal and cultural value systems influencing policy in these areas.

-University Studies 391. Seminar in Environmental Studies. (Cr. 1 each time taken.) Seminar discussions of various topics of environmental concern.

Junior year -University Studies 391. (See above.)

Senior year -University Studies 421. Policies and Procedures for Evaluating Environmental Impacts. (Cr. 3) Prereq: 222 or 223. History of the National Environmental Policy Act (NEPA), the Council on Environmental Quality, and the Environmental Protection Agency. Review of agency guidelines under NEPA and other federal statutes relating to environmental quality. Field trips.

-University Studies 391. (See above, Sophomore year)

Flexibility is provided by a thirty-credit Area of Emphasis. Areas of Emphasis are individually designed to allow students to work toward their own objectives. The environmental studies curriculum committee maintains an up-to-date list of disciplinary courses acceptable in Areas of Emphasis. This listing now contains 127 courses from 32 departments. Areas of Emphasis must be approved by the Environmental Studies Curriculum Committee and the Coordinator. Examples of actual Areas of Emphasis appear in Table 1.

Students may follow either of two tracks in environmental studies: (1) Major: In three of our undergraduate colleges, students may major in environmental studies. But, because of our firm conviction that "generalists" make poor environmental problem solvers, those students majoring in environmental studies must also have disciplinary majors. This restriction places a heavy burden on our students, but those who make it are well prepared for their careers. (2) Program: While the other two undergraduate colleges do not offer the environmental studies major at this time, students in these colleges can complete the 45-credit curriculum as a Program. When they do, the Coordinator notifies the Registrar and a statement recognizing the completion of the Environmental Studies Program is recorded on the student's transcript. This statement appears directly below the indication for the "Degree Awarded".

As of the spring quarter of 1977, there were 60 students in the Environmental Studies Program. Fifty-two of these are majors and eight are completing the curriculum as a program. These 60 students have disciplinary majors in 30 departments and engineering specialties.

Special Programs

Environmental studies students are encouraged to incorporate independent study projects into their Areas of Emphasis. These projects range from small research or service projects (1 or 2 credits) to quarter-long, formal internships. Each activity is pursued on a contract basis and is supervised by a faculty member with expertise in the project area. Projects and internships that allow students to experience new environments and cultures are especially encouraged. Students are also encouraged to become involved in regional and national environmental organizations and professional societies.

Evaluation

The test of any academic program lies in the quality of the students it attracts, their enthusiasm, and the successes they experience after graduation. The quality of our students is high. Nearly half of them are in the University Honors Program. Not only do our students excel academically, they show a dedication and commitment rarely seen in disciplinary majors. Enthusiasm for environmental problem solving and for the Environmental Studies Program is also high among our students. They are our best recruiters. Ours is a young program. We, therefore, have not been thoroughly tested for career success. Thus far, however, our graduates are getting desirable jobs with consulting firms, newspapers, research programs, conservation agencies, and regulatory agencies. Others are in law school or other graduate training. Our evaluation is, therefore, incomplete, but, so far, all signs are positive.

Extension Program

Our objectives in our extension program are essentially the same as those of our undergraduate program. The major difference is that our extension students are already professionals in policy-making or educational positions. These students are mainly teachers from the K-12 system, community college faculty, and business leaders. By teaching teachers, we are attempting to maximize the "multiplier effect" obtained when our students, in turn, teach others. By teaching policymakers, we hope to maximize immediate returns on our efforts. Our offerings include credit courses, workshops, conferences, and a traveling speakers' bureau.

Environmental Clearinghouse

The environmental studies office maintains a small library of environmental journals, government publications, environmental impact statements, reference books, magazines, and textbooks. We also maintain a clipping file from regional newspapers and the NEW YORK TIMES. These materials are catalogued and cross-referenced to provide easy access for students and interested faculty. The environmental studies office also serves as an information and referral center for environmental inquiries coming to the University, coordinates the organization of environmental seminars, and cooperates with other University units in organizing conferences and symposia on environmental topics.

Graduate Program

As noted above (History), we are now in the process of reviewing a proposal for a graduate program. If we proceed with the development of a graduate program, it will focus on providing professional training in three fields where the need for graduate-level, integrative, environmental expertise has been firmly established; environmental impact assessment, environmental communications, and environmental education.

SUMMARY AND CONCLUSIONS

At Iowa State University the Environmental Studies Program provides an undergraduate major, an extension program, and a clearinghouse for environmental information. A graduate program is in the planning stage. The entire Program is built on four premises. Interdisciplinary environmental studies should:

1. include a strong emphasis on integrative content, techniques, and ideas.
2. be firmly grounded on disciplinary expertise,
3. be primarily problem-focused, and
4. be designed to serve the diverse goals and needs of the students involved.

The Program was developed and operates with a small permanent faculty (two persons) and a larger staff of cooperating faculty who provide specialized input. The composition of our cooperating staff varies with changes in the structure and content of our course offerings. Cooperating staff participation is formalized by a "memorandum of agreement" system. This system seems to be the best system for Iowa State University.

The future for environmental studies seems bright. As environmental problems intensify, we are becoming increasingly aware that new, integrative perspectives and approaches are needed if we are to solve even the simplest of these problems. Society is beginning to ask questions about our relationship to our environment. Our job, in environmental studies, is to prepare students to help answer these questions.

NOTES

1. Environtology Council minutes, September 8, 1970.
2. As stipulated by the Environmental Studies General Organization Plan, 15 May 1977.
3. As stipulated by the Environmental Studies General Organization Plan, 15 May 1977.

SCHOOL OF NATURAL RESOURCES, THE OHIO STATE UNIVERSITY

by John F. Disinger and Gordon E. Gatherum*

That environmental studies are not simply spinoffs of a 1970 "E-Day" is abundantly documented by the October, 1968, faculty proposal calling for the assembly of a School of Natural Resources within the College of Agriculture and Home Economics at The Ohio State University: "The goal is a holistic view of man in relation to his natural resource base . . . Of special concern are the means by which individual resources may be managed as an integral part of a total natural resources system which embraces a high quality environment. . . ." The resulting SNR offers bachelor's and master's degrees, conducts research, and carries on public service activities under five interacting functional Divisions: environmental education, fisheries and wildlife management, forestry, parks and recreation administration, and resource development. Student enrollments have risen dramatically from 179 majors in 1968-9 to 1,364 in 1976-7. But a faculty self-study believes the growth in resident instruction has been "at the expense of the development of research and extension programs," except principally in forestry. Through a current faculty long-range planning process, the OSU/SNR continues to sharpen its focus on adapting a professional school of natural resources management to the impulses and imperatives of an environmental era.

American society expects its universities to preserve, transmit, and generate knowledge. In the case of land grant universities, expectations along these lines have been written into the general provisions of the laws and guidelines setting forth the purposes of resident instruction and extension programs which transmit knowledge, and of research programs which generate knowledge.

The School of Natural Resources (SNR) of The Ohio State University is an academic unit within the College of Agriculture and Home Economics of a major land grant university. Therefore, it is expected to transmit knowledge through its resident instruction, extension, and public service programs, and to generate knowledge through its research programs. Furthermore, through its administrative unit and five divisions that administer these programs, it seeks to generate, transmit,

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and preserve knowledge by furthering the development and continuity of each of its areas of academic concern.

As stated in a recently-drafted Long-Range Planning Study:[1]

> The primary goal in the School of Natural Resources is to develop and maintain natural resources programs in extension, research and resident instruction comparable with those programs of the nationally/internationally recognized Colleges and Schools of Natural Resources in the United States.
>
> 1. The primary goal in extension is to develop and maintain extension programs encompassing an information delivery system that insures maximum opportunity for Ohio clientele to effect proper management of the natural resources of Ohio.
> 2. The primary goal in research is to develop and maintain problem-oriented research programs that help provide the information needed to insure proper management of the natural resources of Ohio and the nation.
> 3. The primary goal in resident instruction is to develop and maintain undergraduate and graduate programs that provide individuals qualified to perform effectively in managerial, research, and/or educational roles in natural resources.
>
> Within this broad framework, each division has identified specific programs in extension, research and resident instruction toward which its goals are oriented.

Historical Background

At The Ohio State University, instruction preparatory to professional employment in natural resources was offered for many years prior to the creation of SNR; for example, instruction in forestry is traced back to 1881. Extension forestry programs, authorized by the Clarke-McNary Act of 1924, have been in existence in Ohio since 1925. Forestry research began at the Ohio Agricultural Experiment Station in 1904 and has continued to the present time; during the 1960's, the forestry research department at the Ohio Agricultural Research and Development Center (OARDC) developed a strong program in forest biology which continues.

An interdisciplinary, intercollege curriculum committee was formed in 1945 to coordinate instruction in natural resources. Under its auspices, a conservation curriculum was organized and offered through the College of Agriculture and Home Economics. Specializations available through this curriculum included conservation education, fisheries and wildlife management, park naturalists, and soil and water conservation. Additionally, a pre-forestry and a four-year forest industries program were available through the Department of Horticulture and Forestry.

In recommending the creation of the School of Natural Resources in 1967, the University's Council on Academic Affairs proposed the school "initially serve as an administrative unit to bring together the various groups interested in the formulation of programs of instruction, research and extension in natural resources," with the charge of developing high quality professional programs.

Thus, SNR was "conceived as being concerned with instruction, research, and continuing education related to management of natural resources . . . .Its programs focus on the interactions among the component parts of man's natural environment wherein social factors and political practices as well as natural phenomena are recognized as co-determinants . . . . the goal is a holistic view of man in relation to his natural resource base. . . . Of special concern are the means by which individual resources may be managed as an integral part of a total natural resources system which embraces a high quality environment. . . ."[2]

Divisions recommended and approved at the time of the School's formation included:

Conservation and Outdoor Education (now Environmental Education);

Fisheries and Wildlife Management;

Forestry and Forest Industries (now Forestry);

Park Administration and Outdoor Recreation (now Parks and Recreation Administration); and

Resource Development and Conservation (now Resource Development).

The first four units were organized as instructional divisions in 1968; the Division of Resource Development was activated in 1971. The forestry research program at OARDC was at that time transferred from the Department of Horticulture and Forestry to SNR; extension functions in forestry, outdoor recreation, and wildlife management also were transferred to SNR.

The Natural Resources Institute, the operational arm of the intercollege curriculum committee, provided the nucleus for the School of Natural Resources. The four faculty of the Institute were augmented with faculty from other units, and new appointments, bringing initial faculty strength to 15. Currently, SNR has a faculty of 30.25 full-time equivalents (FTE) carrying out responsibilities in research, extension, and resident instruction (Table 1). During the same nine-year time span, student enrollments have grown from 179 undergraduate majors in 1968-69 to 1353 majors, undergraduate and graduate, in 1977-78 (Table 2). Current student enrollments by division are shown in Table 3.

TABLE 1.—SNR Faculty, Autumn 1977*

Division	Resident Instruction	Research	Extension	Courtesy & Adjunct[1]
Environmental Education	4.70	0.80[2]	0.00	2
Fisheries and Wildlife Management	3.00	1.35[3]	0.65	6
Forestry	3.55	9.40[3]	1.30	2
Parks and Recreation Administration	3.60	0.75[3]	0.65	0
Resource Development	0.75	0.25[3]	0.00	6
Administrative Unit[4]	3.20	0.20[3]	0.10	0
Total	18.80	12.50	2.70	

*Expressed in terms of Full-Time Equivalents (FTE)

[1] Includes faculty from other on-campus units, plus non-university professionals, not paid through SNR accounts.

[2] Includes appointments with ERIC/SMEAC.

[3] Includes appointments with OARDC.

[4] Includes Director, School Secretary, Administrative Assistant, and Director of Barnebey Center for Environmental Studies.

TABLE 2.—GROWTH OF THE SCHOOL OF NATURAL RESOURCES, in terms of Student Enrollments*

Year	Undergraduate Majors	Graduate Majors
1968-69	179	0
1969-70	200	0
1970-71	315	37
1971-72	427	45
1972-73	652	48
1973-74	863	56
1974-75	748	67
1975-76	1092	131
1976-77	1224	140
1977-78	1216	137

*Includes all students carried in active files, including those freshmen and sophomores registered as SNR-intended and those students not officially enrolled during the quarter when the count was made.

TABLE 3.—SNR PROGRAM MAJORS, BY DIVISION, Autumn Quarter 1976*

Division/Program	Under-graduate	Graduate	Total
Environmental Education	99	26	125
Fisheries and Wildlife Management			
Fisheries Management	37	6	43
Wildlife Management	182	20	202
Forestry			
Forest Industries Management	82	0	82
Forest Resource Management	57	3	60
Forest Biology	11	9	20
Parks and Recreation Administration	163	25	188
Resource Development	97	19	116
Undeclared	18	0	18
Totals	746	108	854

*Includes only students officially enrolled in SNR during Autumn Quarter 1976; does not include students (mostly freshmen and sophomores) registered as SNR-intended, or not enrolled Autumn Quarter 1976.

Current Status and Planning

Two current activities of the School of Natural Resources serve to sharpen the School's focus on what it currently is, and where it intends to go. One of these activities is a Long-Range Planning process,[3] undertaken at the direction of the School's executive committee; the other is a University-mandated Self-Study exercise,[4] instituted to determine the appropriateness of the School's goals and objectives and its effectiveness in meeting them. Most of the information in this paper is derived from one or the other of these studies; SNR faculty have had the advantage of using the two activities in a complementary fashion, along with the agonizing task of agreeing upon, and clearly stating, both current status and future projections. It is a fair statement that the School's organization in five divisions complicates both tasks, at the same time as it facilitates the accomplishment of the School's activities.

Resident Instruction

The Self-Study has identified "five functional areas of knowledge" appropriate for consideration in resident instruction programs:

1. The physical and biological nature of primary natural resources components such as forest trees, wildlife, soils, and their ecological relationships;

2. The socio-economic principles of natural resources management;

3. Natural resources techniques; i.e., skills contingent upon a knowledge of the physical, biological, and socio-economic components, including techniques and processes of inventory-data processing, public opinion assessment, education, communication, interpretation, manipulation, and protection of the ecosystem, etc.;

4. Institutional arrangements that influence natural resources management, including legal, ethical, cultural, political, and historic considerations;

5. Natural resources management and administration, involving the integration and application of the biological, physical, socio-economic, technological, and institutional components in the development, implementation, and administration of natural resources management plans.

In essence, all divisions have identified instructional activities related to all five areas, necessitating cooperative effort among divisions in avoiding duplication and/or gaps. This task is complex in itself; it has caused numerous negotiating sessions between and among representatives of the divisions. However, even greater complexity is faced when one considers the full range of academic specialties concerned with these "functional areas" on a campus as large and diverse as Ohio State's. Similar dialog results in interchange of ideas, fruitful negotiation, and occasional high levels of frustration.[5]

Parenthetically, it must be noted that the course offerings of all divisions, and indeed of nearly all academic units on campus, are available to qualified students majoring in any of SNR's areas of specialization. Indeed, each specialization lists a number of requirements, and many course options, among and across colleges and departments throughout the University. Likewise, the course offerings of each division are open to students from all areas of the University community, assuming interest and qualification. Many such students do register for SNR offerings; it does work both ways.

Environmental Education

The Division of Environmental Education has identified three foci for its resident instruction programs: environmental interpretation, environmental communications, and environmental education. The interpretation program is the most thoroughly developed of the three, including the study of the concept of the interpreter, interpretive principles and techniques, visitor characteristics, information services, interpretive exhibits, interpretive planning and programming, evaluation, research and theory. Environmental education utilizes a content and methodological base including study of concepts of environmental and natural resource management, gaming and simulation, resident outdoor education, curriculum development, conservation education methodologies, research, evaluation, and theory. Communications programs are at present in their infancy, but are being cooperatively developed with the School of Journalism and the Departments of Communications and Photography and Cinema.

Fisheries and Wildlife Management

Two programs are offered by the Division of Fisheries and Wildlife Management, fisheries management and wildlife management. Both offer flexible curricula enabling students, in consultation with advisers, to develop individualized programs of study. Each program requires a core of courses designed to make the student a biologist. Utilizing course options and electives, students may develop their special interests within these broad programs. Such special interests include, but are not limited to, land management for wildlife production, wildlife control, fish or wildlife interpretation, fish or wildlife communications, fisheries management, fish production, and environmental assessment.

Forestry

Three programs are offered by the Division of Forestry: forest industries management, forest biology, and forest resource management. A major in forest industries management provides an education in the economics and management of wood-using industries, with a background in forest and wood sciences and a substantial exposure to business administration. The forest biology program prepares students for graduate study and research in that area. This program is weighed strongly toward the natural sciences, in addition to a core of forestry courses required of all forestry majors. Options in forest biology include forest soils, forest tree nutrition, forest genetics, tree physiology, silviculture, and forest ecology. Students in forest resource management prepare for management-administrative positions with public agencies and private industry. Special emphasis is placed on courses in economics, management, and systems analysis.

Parks and Recreation Administration

The curriculum of the Division of Parks and Recreation Administration consists of a single program providing an education leading to "middle" level management type positions, with the following related entry level employment options: recreation resource planning, site maintenance operations, park ranger or watercraft officer, recreation leadership, interpretive services, research methods, multiple use land management, leisure enterprise management, education certification, and parks and recreation communication.

Resource Development

Programs in the Division of Resource Development include land and water resources policy and planning, environmental monitoring and assessment, systems management techniques for natural resources agencies, and energy and mineral resources management. These programs provide interdisciplinary educational opportunities for students interested in preparing for careers in the public or private sectors, and make use of a wide variety of course offerings from other divisions and departments across the campus.

Doctoral Programs

All divisions offer undergraduate (B.S.) and graduate (M.S.) degrees in Natural Resources, but to date the School of Natural Resources has not been authorized to develop Ph.D. programs. Some graduate students pursue doctoral studies in natural resources through arrangements with other departments of the University, such as Agricultural Education, Agronomy, Botany, Genetics, Zoology, and several units of the College of Education. Some of the faculty members in the School of Natural Resources have joint appointments with one of the aforementioned academic units.

Also, some doctoral students participate in the interdisciplinary "one of a kind" option of the Graduate School. A priority recommendation of the School's Self-Study Committee relates to the development of appropriate Ph.D. programs in Natural Resources.

Research

Growth of research programs within SNR has not paralleled that of resident instruction programs. As noted previously, forestry research programs have been and continue to be strong, primarily through activity associated with the Ohio Agricultural Research and Development Center, an off-campus facility located at Wooster, Ohio—90 miles from the main campus. Forestry's research programs are directed at developing knowledge and techniques which will aid in the management of Ohio's nearly seven million acres of forest land for the production of a variety of goods and services.

As noted in Table 1, research support in other divisions pales by comparison to that of forestry. The Division of Fisheries and Wildlife Management, which currently has 1.35 FTE assigned to research, investigates new techniques related to managing the interactions among animal communities, their habitat, and man. Developing new information about the effects of proposed or existing management practices and recreation activities on park and recreation lands, economic analysis of recreation programs and management activities, determining and directing the influence of the five formal powers of government on recreation land use, and analyzing and developing improved systems for the management of park and recreation areas occupy the research efforts of the Division of Parks and Recreation Administration.

Research in the Division of Environmental Education is concerned with areas of environmental message targeting via various media, as well as the development of tested modules for instructional purposes. The only formal research opportunities presently available to faculty in this division are through a cooperative arrangement with the College of Education in the activities of the ERIC Information Analysis Center for Science, Mathematics, and Environmental Education.

Identifying significance and measuring magnitudes of environmental resource problems, analyzing requirements and evaluating effectiveness of land and water resources policies and programs, and meeting needs related to government involvement in natural resources information and data systems are areas of concern in the research program of the Division of Resource Development.

It should be noted that the aforementioned research efforts are supported by appropriated and grant funds; no indication is made of student-originated research, or of less formal research efforts of the faculty. Clearly, lack of doctoral programs except those developed cooperatively with other units, and heavy teaching loads, minimize opportunities for research by most SNR faculty. Moreover, only 13 percent of SNR's current research budget is obtained from sponsored research funds, while comparative figures indicate that natural resources research programs at four other land grant universities average 55 percent of such funds. This finding of the Self Study Committee led to a recommendation that additional efforts, and faculty time, are needed to attract "soft money."

Extension

The Smith-Lever Act of 1914 created the Cooperative Extension Service (CES) and gave it broad directives to carry out nationwide educational programs in all segments of agriculture and related areas. This act provided for mutual cooperation of the U.S. Department of Agriculture and land grant universities in conducting agricultural extension work, and specified that the work

> . . .shall consist of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications, and otherwise. . .

Extension forestry programs were authorized by the Clark-McNary Act of 1924 and have been in existence in Ohio since 1925. Wildlife extension programs have been operational since 1951, while outdoor recreation extension programs were initiated in 1966.

The extension program of the School of Natural Resources has remained relatively constant since the formation of the School. Presently there are 2.70 FTE faculty with OCES appointments (Table 1), representing the Divisions of Fisheries and Wildlife Management, Forestry, and Parks and Recreation Administration. The Divisions of Environmental Education and Resource Development have no OCES support or mission at the present time.

Each extension specialist is responsible to a division chairperson for the planning, conduct, and evaluation of his/her programs. Extension administration requires the preparation of an annual plan of work and an annual report of results, as well as monthly activity reports. The four specialists sharing the 2.70 FTE identify 18 distinct program objectives in their annual reports and all employ a full range of methods in the conduct of their programs—individual contacts, group meetings, demonstrations, subject matter publications, and mass media. Each has programs or sub-programs specific to youth and adults. Facilities used by extension specialists cover the entire state, including both private and public lands.

Only 1.25 percent of the total FTE's assigned to extension duties with OCES are identified as natural resources personnel. An additional 3.50 percent are identified as community resources personnel, while the remainder are identified with agriculture and home economics.

In addition to formal OCES activities, essentially all SNR faculty are involved in "public service." Activities range from "one-shot" workshops with local school teachers and/or children, through active participation in a multitude of local, state, and national professional organizations representing the spectrum of scientific and natural resources management groups, to participation and leadership in national and international conferences.

Facilities

The offices of the five divisions and of the administrative unit of the School are currently located in five separate buildings across the OSU campus in Columbus and the Ohio Agricultural Research and Development Center in Wooster. A long-felt need of the School's faculty has been that of closer proximity, to promote improved interdivisional communication as well as for administrative convenience. Additionally, students find themselves frequently crossing the campus for classes, consultation with advisers, and the like. A major recommendation of the Self-Study Committee is directed toward the solution of this problem.

Under a proposal recently approved and funded, all of the Columbus campus offices of the School will be housed in a new building to be shared with the Departments of Agronomy and Plant Pathology. Projected completion date for this building is 1980.

Two other facilities of the School deserve special mention. SNR has a 1320-acre field site, the Barnebey Center for Environmental Studies, located in the Hocking Hills area about 45 minutes southeast of the campus. Most of the acreage came as a gift to the School of a church-administered summer resident outdoor education facility. Currently, the Barnebey Center is used primarily for a resident field course in wildlife management, and for environmental education resident outdoor education programs involving university students and, on occasion, public school children. Other divisions, and other units of the University, have conducted occasional short courses and field studies there; a few field research projects also have been established at the site. There has been much concern over the future of the Barnebey Center; major construction, or at least renovation, is needed before it can fulfill its potential as an instruction and research center. To these ends, a "Barnebey Center Master Plan" has been developed and submitted to the University's Office of Campus Planning and Space Utilization.

The Pomerene Forest Laboratory, a 230-acre tract of land near Coshocton, Ohio, has been utilized since 1971 for forestry research. More than 30 separate research plantings have been established, mostly related to artificial regeneration of forest stands for a variety of purposes. Objective of the program there is to provide better trees, cultural methods, and management systems for forest resource managers in Ohio to assure the availability of adequate forests and forest products for future generations. In addition, field days are conducted at Pomerene to inform the general public about forestry research and its applications in improved forest, Christmas tree, and plantation management.

Summary

It is clear from this report that the School of Natural Resources of The Ohio State University has undergone great growth since its inception nine-plus years ago, but that its greatest growth has been in terms of student enrollments. All other growth factors have been secondary, and in fact have been impeded markedly by the need to provide resident instruction services—teaching and advising. There was a strong Forestry research program in 1968, and there is today; all other research programs lack significant support. Extension is maintained at approximately the same level of support as nine years ago.

The faculty of the School of Natural Resources take great pride in their accomplishments; feedback from students, alumni, and external agencies, organizations, and industries indicates general satisfaction with the performance of the School. New resident instruction programs have been created, new courses have been designed and developed, more and more students and majors have been accomodated. All of this has, however, been at the expense of the development of research and extension programs. In its self-study report, the School's faculty continues to recommend improvement in all three areas, at the same time it calls for resource support which makes it possible.

NOTES

1. School of Natural Resources, The Ohio State University, *Long-Range Planning Study* draft, 1977.

2. *Proposal for the Establishment of an Undergraduate Curriculum, a Bachelor of Science Degree, and a Master of Science Degree Program in the School of Natural Resources, College of Agriculture and Home Economics, The Ohio State University*, October 1, 1968.

3. *Long-Range Planning Study* draft, 1977.

4. School of Natural Resources, The Ohio State University, *School of Natural Resources Program Review: Self-Study Report*, 1977.

5. The senior author of this case study has had the advantage, as junior editor of this compendium, of having read all the papers in the volume. He assures readers that the "turf" problems of OSU's School of Natural Resources are functionally equivalent to those discussed in many of the other papers included.

ACADEMIC AND RESEARCH PROGRAMS IN ENERGY MANAGEMENT AND POLICY OF THE ENERGY CENTER OF THE UNIVERSITY OF PENNSYLVANIA

by Lawrence Eisenberg*

Well before the "energy crisis" entered the public ken in 1973, the University of Pennsylvania had established a National Center for Energy Management and Power, with a three-fold mission of teaching, research, and outreach. The Center coordinates basic and applied interdisciplinary studies in the technical and policy aspects of energy management. The Center also offers an interdisciplinary Energy and Policy Management graduate program around the master of science and doctoral degrees. While the Center's faculty hold their appointments in other University departments, the manner in which the programs have been implemented provides that professors can continue to "receive recognition and reward within their disciplinary community while making inroads into the less developed energy research community."

Introduction

The University of Pennsylvania established the National Center for Energy Management and Power in 1971. The original organization of the program has since evolved into a research and administrative arm of the University, the Energy Center, and a graduate academic program in Energy Management and Policy. Today, the Energy Center, with ongoing support from the University, offers an interdisciplinary academic program structured around the Master of Science and Ph.D. degrees in Energy Management and Policy.

From the beginning, those connected with the Energy Center appreciated it as a unique experiment in graduate education at the University of Pennsylvania. All were aware that, if successful, it would set a pattern for many other interdisciplinary educational programs in energy and other areas. After five years, the Energy Center continues to attract research as well as to support a full curriculum in Energy Management and Policy.

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Purpose of the Energy Center

Since its inception, the Energy Center has concerned itself with the technical and policy aspects of a number of issues composing the energy state of the nation: 1) the evergrowing demand for energy required to maintain and improve the quality of life; 2) the deteriorating position of domestic energy reserves in oil and natural gas; 3) the increased national commitment to the protection and enhancement of the physical environment; 4) the unanticipated delays in development of power-generating technologies, especially nuclear energy; 5) the emerging strategic role of energy self-sufficiency in national security; and 6) the uncertain prospect of future energy scarcities coupled with the need to plan for efficient and equitable allocation of available energy supplies. These issues are overlapping and their resolution often involves conflicting national priorities. Together, these energy issues characterize a complex environment for energy policy analysis and decision-making.

Within this context, the general purposes of the Energy Center have been twofold: 1) to educate "problem-solving" individuals to address the multidisciplinary field of energy, and 2) to sponsor interdisciplinary research with the goal of contributing to the solution of the nation's current and projected energy problems.

Role of Academic Study at the Energy Center

Numerous energy analysts have suggested that the long-term solution to our energy problems may require significant changes in energy flows between the supply and demand sectors. Well and broadly educated individuals will be needed to develop innovative energy alternatives for use in our society.

The Energy Center prepares persons to face the challenge of complexity in interdisciplinary energy systems and the opportunities that our growing energy systems offer for innovative change. The students in the Energy Management and Policy program develop broad analytic skills in their course-work which they are then encouraged to use in the articulation of energy issues in their research. Research activity has been assigned a primary role in training graduate students in Energy Management and Policy. A "learning-by-doing" educational philosophy provides for research to complement the academic program.

The core curriculum of the EMP degree programs provides a broad intellectual foundation covering the necessary breadth of interdisciplinary study. Individual courses focus on technical, economic, environmental, and social aspects of energy management as well as more generic topics in problem-solving from decision theory and policy systems analysis. Students are given great flexibility to design their own academic research through independent study.

In addition to core studies in energy management and policy, each student is encouraged to pursue advanced graduate education in a related discipline. These studies have included complementary course work in electrical, mechanical, and systems engineering, economics and the social sciences, business and finance, and mathematics and the natural sciences. Many of the students secure additional graduate or professional degrees in their areas of specialization. The students involved can then bring specific and substantive analytic capabilities to some of the problems dealt with at the Energy Center.

The simultaneous requirements of broad, multidisciplinary education in energy problem definition and thorough training in disciplinary problem-solving have given the program a distinctive character. The students, upon graduation from the degree program, have been uniquely qualified for entry into positions of responsibility in both the public and private energy sectors.

Role of Research at the Energy Center

The Energy Center is committed to the development of useful information and analysis applicable to energy decisions that face the nation. Because of the complexity and interdependence of social, economic, and environmental systems, the nature of energy problems generally implies a broad interdisciplinary approach to problem-solving. Therefore, the Energy Center places great emphasis on the interdisciplinary perspective.

Energy problems and issues can be posed as present choices between alternative technologies and life-styles for future generations. These choices can hinge on careful evaluation of the feasibility of new technologies, on their societal and economic viability, the environmental impact of energy developments, and the contribution of these energy technologies to the general welfare. In addition, ameliorative approaches to our energy problems can include new policy alternatives that can be evaluated and implemented in the realms of economic and institutional arrangements.

The Energy Center has performed a broad range of research projects that have dealt primarily with interdisciplinary problems in energy technology and policy.

University Resources Available to the Energy Center

The University of Pennsylvania offers a depth and richness of academic opportunity practically unmatched for studies in energy problems. The academic courses available to students in Energy Management and Policy are offered in the Moore School of Electrical Engineering (electrical, systems), the College of Engineering and Applied Sciences (civil, mechanical), the Wharton School (business and finance), and in the varied disciplinary departments of the College of the Arts and Sciences.

The success of the Energy Center, in its academic and research programs, has been largely derived from the participation of University faculty who are at the forefront of their substantive disciplines. Their deep interest in contributing to the alleviation of energy problems has allowed the Energy Center and its students to benefit from education in and application of analytic tools. The Graduate Group faculty members who offer the courses in the Energy Management and Policy core curriculum, and who act as project managers in research projects, generally serve on the Graduate Group Committee for Energy Management and Policy.

The Graduate Group is part of the Graduate Faculty of the University of Pennsylvania, and is composed of faculty members from various disciplines with a significant interest in energy matters. The Energy Center does not currently have a faculty of its own appointment, but obtains the teaching and research contributions of the Graduate Group members. The Graduate Group administers the educational activities of the program in Energy Management and Policy, selecting core courses and structuring degree requirements. These faculty provide impetus to the underlying concept of interdisciplinary study in energy issues.

The interdisciplinary framework of the Energy Center, and its dominant orientation to research, would be made difficult if the program were dealt with, administratively, as a department within the University. For this reason, the academic program in Energy Management and Policy, and the research program of the Energy Center, have been made accountable directly to the Office of the Provost. The Energy Center enjoys the strong support of the University administration, and in this arrangement has great flexibility in securing research projects and determining curricular and other academic priorities.

THE ENERGY CENTER CONCEPT: INTERDISCIPLINARY STUDY OF ENERGY SYSTEMS

The Energy Center of the University of Pennsylvania has an extensive research and academic function. Any University program which emphasizes interdisciplinary study and problem solving requires a rationale that can be shared and related to by the various participants--both faculty and students. This section attempts to capture the conceptual underpinnings that structure Energy Center activities.

Goals of the Energy Center

Many of the nation's current energy problems have resulted from the failure, in energy decision-making, to perceive the full range of functions and interrelationships within energy systems. Public and private policies, designed to resolve narrowly defined energy problems, have frequently caused more significant problems to be dispersed throughout the entire energy system. The reason that energy problems have become so important to the nation, as compared to problems in the exploitation and use of other resources, is that energy represents the input most critical to the technological processes serving American society. Consequently, energy may be considered a prime determinant of the economic and social health of the nation.

From the system's perspective, total energy systems function from an inherent congruence among technological options with nature, man, and society. Energy resource inputs and conversion processes create valuable economic opportunities and social conveniences for man and society. Our systems of production, transportation, and interior environmental control are all driven by some useful form of energy. However, some of the by-products of energy conversion and use may also create serious problems for nature, man and society.

Systems relationships comprise the basic structure for analyzing energy problems. The flows of the total energy system and their full impacts on natural, human, and social systems need to be analyzed carefully and comprehensively in developing good energy alternatives. Hence, individuals being trained to be designers of energy systems should learn how to build these alternatives using a wide spectrum of scientific, technological, and institutional options.

The Energy Center seeks to produce systems analysts in the broadest sense of the word. These persons, sensitive to the breadth and complexity of total energy systems, would be best suited to the integrated planning, design, construction, and management of energy systems in the future.

Analysis of Energy Systems

The Energy Center concept is founded on extensive analysis and careful synthesis of energy systems. The analyses required to identify and solve current and projected energy problems embrace a wide range of techniques and disciplines. The interrelationships between energy use and natural and social systems dictate that a broad area of scientific knowledge be considered in defining appropriate solutions to the nation's energy problems.

The Energy Center is concerned both with the potential technologies and the policies that can lead to the provision of adequate future energy supplies. In its academic and research activities, the Energy Center has attempted to evaluate many energy options for their potential suitability in supplying appropriate energy capability to the nation. Evaluation is based on five feasibility analyses which constitute an analytic framework for the Energy Center approach: (1) scientific, (2) technical, (3) environmental, (4) economic, and (5) societal feasibility analyses.

Assessment of technological options in energy consists of a standard analytic sequence. The basic definition of scientific feasibility refers to the availability of a reproducible scientific phenomenon that can accomplish a required energy objective. Technical feasibility refers to the existence of two or more scientific phenomena which, when combined and applied to some practical use, can achieve the desired objective. Technical feasibility clearly depends on the state of scientific feasibility and follows advances in basic scientific research.

Considering only scientific and technical feasibility, there may be several controllable phenomena which, when combined in appropriate applications technically, can make accomplishment of a given objective possible. Technologies that satisfy these feasibility tests represent a range or options from which decision-makers must choose in their planning for and design of energy systems.

The remaining feasibility tests (environmental, economic, and societal) serve as the basis for distinguishing between technological options and selecting those most appropriate to and compatible with the full scope of national priorities. However, unless scientific and technical feasibilities have been established, extensive environmental, economic, and societal feasibility analyses may not be justified.

Environmental feasibility refers to the ability of the natural environmental media (air, water, and land) to assimilate the outflows from the energy technology under consideration. There ar two dimensions to environmental assimilative capacity: (1) that defined by the natural stability constraints of a complex eco-system, and; (2) that defined more arbitrarily by public, (and political) standards of acceptable environmental conditions. The environmental feasibility of a candidate technology, which may vary with changing regulations or depend upon site-specific environmental assimilative capacities, can be achieved by satisfaction of each of these external constraints.

Economic feasibility refers to the operating cost-effectiveness of a given tehcnological option for achieving an energy objective and the adequacy of available front-end funding to bring the appropriate facilities on-line. These feasibility criteria include the additional operating and initial capital costs required to meet the environmental feasibility criteria. The economic feasibility analysis simply applies a common dollar denominator to all technological options so that cost comparisons can be applied in choosing the technology which will be used to accomplish the desired objective.

Societal feasibility refers to the willingness of the society to accept the technology and its wasteful (as well as its useful) outputs. Even when each of the previous feasibilities of a technology can be indisputably established, the total feasibility of an option may hinge on analysis of its acceptability in the non-technical, popular forum of American society. Analysis of societal feasibility involves an understanding of those changes which will be acceptable to the society at large and, in particular, to the sectors most immediately impacted by its costs and benefits. In the past, societal feasibility has been relatively poorly understood for technologies involving significant departures from conventional operations. The ongoing controversy regarding nuclear generating technology provides a timely example of how important societal feasibility can become in guiding the planning and design of integrated energy systems.

In the analysis of total energy systems, the role of interdisciplinary education and research is to establish the full range of information, and the understanding thereof, necessary to assess the feasibility of each technological option. The role of the traditional disciplines, in this context, is to develop the depth of analytic information to assess each of the five component feasibility analyses.

In this respect, engineers and other applied scientists in the Energy Center assess the technical feasibility of capturing new scientific phenomena for use in energy systems. Faculty and students trained in the environmental, economic, and social sciences can then tackle the difficult issues of the interdependence of energy systems with broader social and environmental systems. Following the collection and synthesis of the relevant information, one can begin to determine the fitness of technological options in the full context of American society. Analyses of the collected information can then provide the constraints associated with related energy decisions.

Planning and Design of Energy Systems

At the Energy Center, students are trained to explore the scope of technical and policy issues implicated in rational planning and design of total energy systems. The nature of management requires the ability to integrate, without undue bias in any single direction, the numerous components of an energy system to make decisions regarding appropriate resource exploitation and conversion, energy facility sitings, energy policies, and a host of other complex and difficult problems. In a realm of opposed interest groups and priorities, rational and fair resolution of conflict regarding the growth and deployment of energy systems requires a manager with firm and comprehensive grasp of the total problem.

With the assistance of the mathematical disciplines, general systems models can bring together the seemingly diverse components of energy analysis to provide the basis for evaluating and resolving complex energy problems. One valuable device for synthesizing energy information and bringing it within the grasp of systems managers has been input-output analysis. The Energy Center has frequently, though not exclusively, employed this framework to represent the complex characteristics of our economy and its concomitant use of energy resources and disposal of energy wastes.

The power of the input-output approach lies in its detailed presentation of the interaction between productive sectors of the nation's economy. It displays the nature of the various inter-relationships among industrial sectors and between the industrial sectors and other economic components of the nation. Given the data provided by an input-output table, the technology which supports the production and distribution characteristics of the economy, and the energy demands of the technology, it is possible to provide consistent and responsive answers to questions of energy policy in our economy.

One of the shortcomings of the input-output approach has been its inability to deal with issues regarding environmental quality. In a major way, man's impact on environmental quality has been directly related to his economic activity as it uses energy resources. Environmental impact is related to a quantitative loading in relationship to the capacity of the environment to assimilate that load.

The analysis which distributes energy and environmental load among productive uses according to interrelationships found in the input-output table is called the energy balance and involves the detailed characteristics of the technology and the local environmental sink. For energy policy, the amount of input energy allowed will depend, of course, on the amount of output product derived by the society and the impact characteristics of the production technology.

Where increasingly complicated models of this type might provide the synthetic framework for considering tradeoffs between energy, the economy, and the environment, societal aspects of energy management must be dealt with in sensitive, qualitative ways. However, with the information generated in analysis of feasibilities, and its contributions to interdisciplinary, synthetic models, the Energy Center has promoted a broad information base for the development of rational and acceptable energy policies. The generalized version of systems theory found in the academic and research programs of the Energy Center has opened the door to innovative and integrative ideas in effective and equitable energy management and policy for American society.

THE ENERGY CENTER CURRICULUM

The Energy Center sponsors a graduate academic program in Energy Management and Policy (EMP). This program is designed to provide each student with a comprehensive education that will enable him to assume leadership in the development and management of sophisticated energy systems.

In keeping with the concept of the Energy Center, the Graduate Program in Energy Management and Policy is a multi- and interdisciplinary curriculum. There is a purposive orientation in the courses toward student definition and solution of energy-related problems.

The EMP curriculum encompasses the technical, economic and social facets of the nations' energy situation. Yet while the curriculum has exposed students to the broad perspective necessary to cover these aspects of energy problem-solving, each student has also been encouraged to extend his previous undergraduate training to the graduate level in energy-related disciplines.

Admissions: The EMP program is a graduate program. Admissions requirements include undergraduate training in a discipline bearing some relevance to energy issues and evidence of strong academic performance. In order to ensure a foundation of basic knowledge, admission is contingent upon completion of a full year's study in the physical sciences, in the social sciences, and in mathematics.

Incoming students generally represent many different undergraduate backgrounds (currently, previous training among the students includes electrical engineering, physics, mathematics, biology, economics, and environmental studies). Hence, the core curriculum is designed to present the fundamental multi-disciplinary knowledge required to analyze energy related problems on a broadly informed basis.

EMP Core Curriculum: Energy Management and Policy, the Energy Center's academic program, leads to both the Master of Science (M.S. EMP) and doctoral (Ph. D.) degrees. Candidates for the M.S. degree are required to complete a program of ten (10) course units and to write a Masters thesis. Doctoral students must first pass a preliminary examination, complete twenty (20) course units, and perform original research culminating in a dissertation. For both degree levels, half of the course requirements must be completed with courses chosen from the EMP core curriculum of ten (10) courses, while the balance of the academic work should be concentrated in the student's area of disciplinary strength.

The core courses provide the EMP student with exposure to the full spectrum of knowledge required to evaluate the feasibility of alternative energy technologies and policies. The analytic perspectives dealt with in the courses cover the five types of feasibility assessment underlying the interdisciplinary concept of the Energy Center: scientific, technical, environmental, economic, and societal. Each of these categories involves expertise in one or more disciplines. The student is expected to utilize effectively information from each of these somewhat distinct topics in order to generate well-integrated solutions to energy problems.

The following EMP courses cover relevant energy topics in each of the areas of interdisciplinary inquiry:

EMP 600. Energy Resources and Technology.

EMP 601. Environmental Aspects of Energy Management.

EMP 605. Social Aspects of Energy Management.

EMP 610. Economic and Financial Aspects of Energy Management.

The balance of the Energy Management and Policy curriculum deals with interdisciplinary approaches to energy systems, generic studies in complex problem-solving, and modeling of energy systems. Students are expected to bring their experience in the functional courses (above) and from previous disciplinary education to the discussion of energy issues in the following courses:

EMP 501. Computer Modeling for Energy Systems Analysis.

EMP 602. Applications of Energy Management of Systems.

EMP 603. Applications of Energy Management to Systems.

EMP 620. Problem Solving Methodology.

EMP 640. Modeling of Energy Systems.

EMP 641. Simulation of Energy Systems.

EMP courses are open to qualified students throughout the University. Course enrollment usually includes students from the engineering and professional schools as well as part-time students from the energy industry.

Elective Courses: A goal of the EMP program is to educate individuals to view energy issues from a broad perspective. EMP degree candidates are expected to pursue advanced studies in one of the relevant disciplines to insure that their contributions to the research and intellectual community of the Energy Center will be of the highest possible professional caliber.

The required breadth and depth of education may be accomplished by pursuing a major in EMP and a minor course of study through elective credits in the student's previous discipline. Because the demands of this arrangement can substantially approach those of a double major, many EMP doctoral candidates have opted for graduate degrees in their specific area of interest. These supplemental studies have included degree programs in Systems Engineering, Electrical Engineering, and the M.B.A. in the Wharton School.

The following list includes the University departments whose elective courses have proven most popular to EMP students:

Architecture (School of Fine Arts)
Business Adminstration (The Wharton School)
Civil and Urban Engineering (The Towne School)
Decision Sciences

Economics
Electrical Engineering and Science (The Moore School)
Mechanical Engineering and Applied Mechanics
    (The Towne School)
Regional Science
Social Systems Science
Systems Engineering (The Moore School)

Independent Research: The academic program of the Energy Center has been designed to educate persons to face the challenges of interdisciplinary energy systems and the opportunities they offer for innovative technological and social change. In order to encourage the development of new ideas and perspectives among its students, then, the Energy Center has actively sponsored independent research. This work can consist of a semester's research and exploration with a faculty member of the Graduate Group, and has often been expanded into material appropriate for the Master's thesis and Ph.D. dissertation. In addition, some of the independent research conducted in the academic realm has laid the foundation for formal research proposals by the Energy Center.

Therefore, the Energy Center offers a wide range of opportunities for students to attack problems that they define and resolve. This represents an integral component of the "learning-by-doing" emphasis in energy education.

EMP Faculty: The EMP curriculum is the responsibility of the Graduate Group in Energy Management and Policy, a multi-disciplinary panel of fourteen faculty members chaired by the Director of the Energy Center. There faculty representatives are generally the most active in the academic and research activities of the Energy Center. In fact, many of the faculty participants are responsible for teaching the core courses.

The Energy Center does not have appointed faculty. Members of the Graduate Group in Energy Management and Policy and the instructors in the EMP courses are drawn from their respective departments. This arrangement assists in integrating existing intellectual resources of the University of Pennsylvania into an interdisciplinary group for the study of energy systems. However, faculty and post-doctoral appointments within the EMP program are anticipated with further growth of the Energy Center.

THE ENERGY CENTER RESEARCH PROGRAM

The purposes of this section are (1) to describe the role of research in the Energy Center, and (2) to provide an overview of the types of research that have been conducted at the Energy Center. The emphasis is upon the research projects, past and current, which have become the core of research experience and expertise at the Energy Center and, therefore, best illustrate its qualifications for future research.

Research at the Energy Center

The Energy Center has sponsored critical discussion of many of the nation's energy problems by providing a meaningful, interdisciplinary research program in the field. Past research projects have been conducted through the support ot the National Science Foundation, the Federal Energy Administration, the Energy Research and Development Administration, the Pennsylvania Science and Engineering Foundation, and the MITRE Corporation, among other funding sources.

As we have seen, integrative planning of the joint systems of society and technology, like the energy system, requires dealing with the whole sequence of activities and impacts implicated in energy supply and demand, extraction, transportation, processing, conversion, distribution, use, and waste disposal. The "systems perspective" involves penetrating deeply into previously autonomous disciplines to exploit the analytic capabilities of the natural and social systems sciences. The approach can contribute significantly to joining these disparate energy activities with a concept of "total energy system."

The organization of the Energy Center has been well-suited to the development of a research program that analyzes the "total energy system." Most of the projects have stressed some aspect of the interrelation of energy, the environment, and economic institutions in studying alternative technologies. Many have dealt with the impact of energy policies on the energy system and the public it serves. The research teams in these projects have been composed of faculty and student specialists in the engineering fields (electrical, mechanical, systems, and civil), operations research, economics, transportation and environmental planning, management, and law. The interdisciplinary nature of the research teams has enabled diverse aspects of energy problems to be fully and appropriately considered.

The University of Pennsylvania Energy Center has a rich background, then, in the technical and policy aspects of energy management research. This research program has involved both technical disciplinary projects and broader multi-disciplinary efforts. Such efforts have been organized to embrace the entire societal, as well as technical, nature of a selected energy problem. Emphasis has been placed on sponsoring this interdisciplinary approach, in Energy Center projects, in order to focus and integrate the entire breadth of the University's intellectual resources on energy problems and issues.

Faculty Participation

The success of Energy Center research has required the continuing commitment of faculty interest and effort to the goals of the program. The key to success has resided in the manner in which multi-disciplinary research has been implemented so that faculty members would continue to receive recognition and reward through their disciplinary community, while making inroads into the less-developed energy research community. Research programs of the Energy Center will continue to be administered by the Director and the Graduate Group in Energy Management and Policy, so as to provide direct disciplinary rewards to the participants, thereby encouraging a continued commitment of the faculty to energy research.

Student Participation

The research projects that the Energy Center has sought have been uniquely suited to significant student participation. The projects have proven a valuable component of graduate education in Energy Management and Policy. The experience of active participation in energy research has provided students with first-hand familiarity and responsibility for problem-solving in the energy field.

In keeping with the organizational concept of the Energy Center, each student in the program has been expected to contribute, in his research, substantive knowledge from his particular disciplinary background. The structure of the research projects, and of the general "community" of the Energy Center itself, have fostered the exchange of the individual ideas and perspectives held among the students as well as the faculty. This interaction, freed from the constraints imposed in disciplinary research, has been a critical component of the interdisciplinary educational process at the Energy Center. In fact, this interaction on energy problems and issues has become the justification for the Energy Center's existence, and has contributed significantly to meaningful and useful research projects in the past.

THE CENTER FOR THE STUDY OF ENVIRONMENTAL POLICY OF THE PENNSYLVANIA STATE UNIVERSITY

by Terry A. Ferrar*

Penn State's Center for the Study of Environmental Policy is a textbook example of the way a land-grant university can adapt its traditional "three-legged stool" posture to an attack on a pressing problem. Through teaching, research, and extension, the Center addresses responsible resource management decision-making in general and the environmental impact of the energy crisis in particular. While the Center itself does not offer courses or grant degrees, it works with existing departments in the development of interdisciplinary programs. Principally by supporting graduate students in cooperating departments, the Center energizes research on broad issues of resource policy and public sector management. The Center then translates appropriate research findings into public knowledge to assist in the resolution of specific contemporary problems, largely in Pennsylvania. Funding comes from general university coffers, private grants, and contracts with federal and state agencies. Core faculty represent an array of disciplines.

The efficient employment of natural resources toward the satisfaction of society's goals requires the attention of our major university communities. An understanding is urgently needed concerning the ways physical, biological, and social systems interact and how policy decisions will ultimately influence all phases of our environment. The mission of the Center for the Study of Environmental Policy is to assist, through faculty and graduate student research, the policy-setting agencies of the state and nation by providing the information and analysis required to reach responsible resource management decisions.

The Center's research addresses the quantitative evaluation of "the environmental impact of the energy crisis." Specific objectives include the promotion of educational opportunities for those concerned with resource policy, the stimulation and direction of basic and

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applied research, and the dissemination and tailoring of existing knowledge to assist in the resolution of specific contemporary problems.

This intercollege unit was established in 1972 by an institutional grant from the Rockefeller Foundation for the purpose of analyzing and suggesting policy alternatives for the resolution of the environmental dilemmas confronting our society. The Center formally reports to the Office of the Vice President for Research and Graduate Studies.

The inherent multidisciplinary character of resource-policy analysis demands the attention of professionals from a variety of research fields. The Center is designed to provide a vehicle for this interaction. Associated core faculty represent several disciplines including economics, sociology, political science, consumer behavior, law, statistics, operations research, and systems analysis. A vital part of the Center' role within this university community is its support of graduate students from cooperating departments. It also serves as an instrument to assist in their interdisciplinary education.

Basic and Applied Research

Research is conducted on broad issues of resource policy and public sector management. Projects are supported through monies from general University funds, private grants, and contracts with federal and Commonwealth organizations.

Energy Policies

Since energy conservation is synonymous with environmental preservation, composite energy-environmental policies that give full recognition to relevant social trade-offs are under study. For example, the Center has addressed the following subjects:

- Total-cost pricing of electricity;
- Location of power plants and the routing of power lines to minimize environmental degradation and socioeconomic factors of the "energy park" concept;
- Development of a set of conservation policy recommendations for review by the Governor's Energy Council of Pennsylvania;
- Psychological and situational considerations affecting such energy-conservation behavior as driving less or slower, turning down residential thermostats, buying efficient appliances, and purchasing returnable instead of nonreturnable containers;
- Conservation legislation assessment such as truth-in-packaging, energy-efficient labeling, and energy taxation.

Administrative Efficiency

An active area of the Center's research is concerned with assisting state and local agencies in achieving increased administrative efficiency. Illustrative of this class of study are the following:

- Development and application of a computerized scheduling and routing package to assist officials of the Pennsylvania Department of Environmental Resources in utilizing their manpower and equipment for pollution inspection and surveillance;
- Evaluation of management-information systems to assist in information collection and transfer within state agencies;
- Preliminary studies for forest-fire suppressions to determine the most effective use-pattern for available manpower and equipment;
- Assessing land-use capability and development of planning models;
- Development of a forecasting technique to assist in the location and expansion-contraction decisions on state recreation facilities.

Related Interests

With competing interests for tax revenues, support for environmental management is increasingly difficult to obtain. Therefore, the Center is addressing itself to the development of alternative funding mechanisms under the "polluter pays" principle. The incentive and revenue characteristics of policies involving emissions charges, fuel-oil surcharges, and surveillance or inspection-fee programs are under study.

The Center forms a flexible, responsible unit for the study of policy issues. The breadth of its response is apparent from the following survey of projects addressed at the request of various public officials:

- The study of legal issues associated with planning land uses in flood-prone areas;
- Development of degradation-cost measures to assess the social and economic impact of environmental neglect;
- Evaluation of businessmen's perceptions of locational hazards;
- Development of a methodology for planning residential development;
- Analysis of the recreational real-estate market and its impact on environmental quality;
- Examination of the effectiveness of financial incentives and regulations in controlling air pollution (during a period of low-sulfur fuel-oil shortage in New York City);

-Analysis of the feasibility of controlling pollutants on a real-time basis;
-Assessment of the institutional problems associated with totally integrated utility systems;
-Development of a benefit-cost methodology for pesticide-use management.

Educational Activities

The Center recognizes as a primary goal of its activities the support of a coordinated academic program through the various departments of the University. Some departments currently offer courses targeted on resource policy, and many others present areas of study essential to a thorough understanding of the subtleties of such issues.

Academic departments are assisted by the Center in their efforts to expand course offerings and to develop new programs. Moreover, the Center behaves as an instrument to assist in the development of interdisciplinary courses and provides guidance concerning professional employment in the area of resource management. While the Center provides this service function to cooperating institutional programs, it does not offer courses or grant degrees.

In addition to these intra-University educational activities, the Center periodically conducts public seminars and conferences on topics of resource management, and it publishes a series of working papers.

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Roger Findley

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

ENVIRONMENTAL PROGRAMS AT THE UNIVERSITY OF ILLINOIS COLLEGE OF LAW*

by Roger W. Findley**

An Illinois steel company is found in violation of the state's air pollution regulations. The fine: $200,000. But the money does not go into the state's general coffers; it is assigned to the University of Illinois as a scholarship fund, principally for students in the Colleges of Law and Engineering, whose faculties had been assisting the state Pollution Control Board. That is only one interesting sidelight in this fascinating case study of a unique Office of Environmental and Planning Studies within a law school. Perhaps of all the professional schools, schools of law needed the least introduction to the environmental era. Many had a long tradition of teaching and research in the fields of property, land use, and natural resource utilization—and a specialized professional journal already in place, the New Mexico Law School's Natural Resources Journal. The Illinois College of Law was already a national leader. It rapidly geared up to strengthen its course offerings, its professional internship program, its research capabilities in concert particularly with engineers and economists, and its public service consultations with the novel environmental protection agencies the state of Illinois "invented" in 1970. Today, while not forsaking its state, regional, and national missions, the College and its Office are increasingly extending their activities beyond the boundaries of the United States, especially into Latin America.

Since approximately 1970 the University of Illinois College of Law has had an unusually active and diverse program in environmental studies. It includes interdisciplinary instruction and internship programs for law students, interdisciplinary and international research programs involving faculty and graduate fellows, and a strong public service element with especially close ties to state environmental agencies. The range of activities, the numbers of persons involved in the program, and outside requests for assistance became so great that a special administrative unit, the Office of Environmental and Planning Studies, was created within the College of Law. The history of the program, its origins, features and results, reflect nourishment of the aspirations and efforts of a few faculty by the cooperation and contributions of many others within and beyond the College and the University.

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Background

The University of Illinois College of Law has a long tradition of teaching and research excellence in the fields of property, natural resources and land use regulation. For many decades its faculty has included pioneers in such fields as land law, mining law and water resources law. For more than twenty years the present dean, John E. Cribbet, has been a recognized national authority in urban planning law. When the three younger persons principally responsible for growth of the present environmental program joined the faculty in the 1960's, they were blessed with a firm foundation on which to build. All were interested in private and public aspects of the ownership and use of land and natural resources.

The group was influenced by the onset of the environmental era nationally and by personal involvement in specific projects and causes: opposition to a proposed Corps of Engineers reservoir which would inundate a forest preserve, development of new laws to preserve Chicago's urban landmarks, lawsuits to reduce pollution of Lake Michigan, preperation of the environment article of Illinois' new constitution, etc. Fresh perspectives from such involvement quickly found their way into the classroom. A course which had focused principally on the private law governing allocation of water soon was concentrating on public management, pollution control and protection of scenic rivers. The urban planning course delved deeply into transferable development rights and other alternatives to conventional zoning and subdivision regulation. Students became excited and sought ways in which to become involved in reform even before they graduated. Summer positions were arranged with public interest law firms specializing in environmental litigation, and faculty employed research assistants in their research and public service activities.

Relationship to State Environmental Program

In 1970 Illinois adopted a comprehensive Environmental Protection Act. This unique and effective law established a triad of public agencies to deal with all facets of pollution in the state: the Pollution Control board, which fixes pollution limits and adjudicates cases of alleged violations; the Environmental Protection Agency, which develops and proposes new standards for adoption by the Board and investigates and prosecutes cases of alleged violations; and the Institute for Environmental Quality, which conducts and finances research to facilitate the activities of the other two agencies. Since their creation in 1970 these agencies have had broader authority and more adequate funding than their counterparts in almost any other state.

Cooperation with the three state agencies has been a major element in development of interdisciplinary research programs involving law faculty and students at the University. This cooperation began in 1971, when a citizens' group in the Chicago area petitioned the

Pollution Control Board to adopt regulations aimed at reducing the impact of jet aircraft noise in suburban residential areas near O'Hare Field, the world's busiest airport. Recognizing that it did not have the data or expertise to respond appropriately to this petition, the Board sought assistance from the Institute for Environmental Quality. The Institute, in turn, called upon the University of Illinois to establish an interdisciplinary group of researchers to investigate the problem and offer recommendations for Board action. The Illinois Task Force on Noise thus was created. It was composed of professors of law, engineering, physics, psychology, physiology and speech and hearing science, plus the chief of the Environmental Protection Agency's Division of Noise Pollution Control and the associate director of the Institute. Later a professor of economics was added. Initially administration of task force activities was handled by the experiment station of the College of Engineering, but subsequently management responsibility was shifted to the College of Law. The charge to the group was to develop a proposal for a comprehensive state regulatory program dealing not only with airport noise but also with noise from other transportation sources and from stationary sources. No state had such a program.

Participation of law faculty in this ambitious undertaking had three important consequences beyond advancement of knowledge pertaining to the regulation of environmental noise. First, close working relationships were developed between participating faculty and the fledgling environmental agencies, which soon came to rely upon University researchers in developing other aspects of the state's overall environmental regulatory program. Second, the law faculty became accustomed to working with specialists in other disciplinary areas, particularly engineering and economics. Third, substantial resources were made available to the task force for employment of full-time research associates as well as part-time student research assistants. Eventually there evolved a comprehensive program, based in the College of Law, involving research and public service on a variety of environmental problems. Research associates in environmental law, who were graduates of leading law schools from coast to coast, came to the University of Illinois for an intensive one-year experience to launch careers in the practice or teaching of environmental law.

The Illinois Environmental Protection Agency also employed students during the summer and established internships under which students could receive academic credit for working with the Agency during the school year. In a number of cases students with such experience were hired on a full-time basis by the Agency upon graduation from law school.

Another result of the University's contribution to the state environmental program, of great benefit to students, was the creation of a $200,000 scholarship fund pursuant to a consent decree between the Pollution Control Board and a steel company found to have violated the Board's air pollution regulations. Payment of the money to the

University was approved by the Board in lieu of a civil penalty. In its decree the Board specifically commended the Colleges of Law and Engineering, with the result that students in those colleges received a substantial proportion of the awards granted from the fund. Recipients conducted independent research projects on matters of significant environmental concern.

Office of Environmental and Planning Studies

The foregoing activities and others involving law faculty became so numerous as to require an internal administrative structure. The Office of Environmental and Planning Studies therefore was established within the College of Law, with a faculty director and a staff consisting of a secretary and research associates in environmental law. The office has responsibility for coordination of the College's teaching, research and public service programs in the environmental field. All law faculty working in the field are associated with the office. The director is the contact point within the College to whom are directed all program proposals and requests for assistance from persons elsewhere in the University, agencies of federal, state and local governments, and the general public. For several years the then Director, Professor Sheldon Plager, now Dean of the Indiana University School of Law at Bloomington, served as a member of the United States Environmental Protection Agency's manpower development task force, which advised the agency on university training programs for environmental professionals and technicians across the country.

The very fact of creation of the office enhanced the visibility of the College's commitment to legal aspects of environmental improvement and generated new opportunities for faculty and students. Other units of the University, such as its Institute for Environmental Studies and Office of Energy Research, have financed and employed research associates in environmental law selected by and holding joint appointments in the Office of Environmental and Planning Studies. Research associates also have assisted in the teaching programs of the Institute and the College of Engineering.

International Programs

The Office's activities increasingly extend beyond the boundaries of the United States, particularly into Latin America. This trend began with the writer's involvement in research on rural and urban land use problems in Colombia. Then another faculty member, John Costonis, was commissioned by the Conservation Trust of Puerto Rico to develop a plan for preservation of some of the island's unique natural areas through the use of transferable development rights. In the Puerto Rico context this technique, largely conceived and popularized by Professor Costonis, would prohibit development of ecologically sensitive areas but allow the private owners of such areas to recover some of the lost value of their properties through sale of their development rights to the owners of other land in designated urban "transfer districts" where greater density not only would be unobjectionable in environmental terms but actually would facilitate implementation of the island's other comprehensive planning objectives.

Additional relationships between the Office of Environmental and Planning Studies and public agencies in Central and South America have been established recently. For some years the College of Law has conducted in Urbana-Champaign and Washington an annual seminar for Latin American public sector attorneys on legal aspects of international business and financing. Funding has been provided by the Organization of American States, the State Department, and private corporations here and abroad. In 1977 the program also was held in Rio de Janeiro with financing from the Brazilian National Development Bank. These seminars now include sessions on environmental law, with special emphasis on environmental impact studies and mitigation measures required as conditions to loans by international institutions such as the World Bank and the Inter-American Development Bank. As a result of the inclusion of this subject matter in the seminars, some Latin participants subsequently have come to the College as graduate students for a full year, on leave from their employer agencies, to study environmental and land use law, a field which is virtually nonexistent in law school curriculums in their own countries.

Further initiatives are being contemplated. Possible formal ties between the College and several environmental research and training agencies in Brazil are being discussed. Such arrangements could involve joint research efforts and personnel exchanges. A number of law schools in Brazil and Colombia also have expressed interest in establishing cooperative programs with the College of Law to enhance their capabilities in environmental education and research.

Environmental Courses and Seminars

The foregoing sections have stressed the research, public service, and post-graduate dimensions of the College's environmental programs. In terms of course offerings for the entire student body, the environmental curriculum is also diverse. The foundation courses are Environmental Law, Urban Planning and Land Use Regulation, and Natural Resources. Beyond these there are specialized seminars in pollution control and land use control and a unique computer-based simulation exercise in which students play the roles of private and public decisionmakers in a metropolitan region in which pollution and land use issues must be confronted in the realistic context of many other economic, social and political demands and pressures.

The Environmental Law course, after offering background perspectives through readings in ecology and economics, focuses on three subject areas: judicial review of public agencies' consideration of environmental impacts in the course of complex decisionmaking, regional and state regulation of private land developments of more than local environmental significance, and pollution control. Considerable attention is given to litigation under the National Environmental Policy Act, the Clean Air Act, and the Federal Water Pollution Control Act. Difficult problems explored at length include procedures for assessment of environmental impacts of new technologies and chemical substances, uncertainties in determining appropriate pollution limits and the feasibility of compliance, alternatives to direct regulation for achieving abatement of pollution, and conflicts among the environmental improvement programs of federal, state and local governments.

The Urban Planning and Land Use Regulation course deals with the legal framework within which land use decisions affecting metropolitan areas are made. The roles of regional, county and municipal bodies are examined, and attention is paid to the increasing impact of federal programs. Among the land use techniques examined are planning, zoning, subdivision regulation, mapping, eminent domain, and transfer of development rights. Problems are viewed from the differing perspectives of governmental agencies, developers, landowners, other communities within the region, and potential residents of the jurisdiction making a decision. Current issues such as municipal growth control, exclusion of poor and minority groups, and designation of adult entertainment zones are considered.

The Natural Resources course from time to time has dealt with both water and mining law. In the former area, topics covered include state legal systems for apportioning surface and underground waters among users in times of shortage, urban water supply institutions, public rights in navigable waterways, conservation of scenic and recreational streams, federal water development and management programs, and interstate allocation and diversion. The coverage of mining law generally has been limited to the contract and property rights of private mineral owners and mining operators, and to state conservation laws regulating private oil and gas production.

In the future Natural Resources probably will be divided into two separate courses, one in water law and the other dealing not only with the mining problems presently examined but also with federal regulation and taxation of mining on private lands and with the use and development (or withdrawal from development) of public lands for mining and such other purposes as lumbering, grazing, recreation and preservation. A new course on Energy Law also will be initiated to focus on public regulatory and research programs related to the production, distribution and pricing of oil, gas and electricity.

Advanced seminars in the College of Law afford students opportunities to explore in depth a variety of specialized subjects, including economic analysis of environmental problems and laws, regulation of aircraft noise, application of the development rights transfer technique, and international pollution control. The Metro-Apex simulation exercise is offered jointly with the College of Engineering and is one of the most successful interdisciplinary teaching efforts on the Urbana-Champaign campus. It is designed to expose participants to practical aspects of the law, technology, adminstration and politics of land use and pollution controls in a metropolitan area. Students participate actively at all times by playing a variety of community roles such as industrialist, realtor, public-interest advocate, attorney, legislator and public adminstrator. With the aid of a computer-based program the events around which the community roles are built mature at an accelerated rate, so that five or more years in the life of the community are encompassed within the semester of approximately twelve four-hour sessions. Students are drawn from a variety of disciplines, including law, engineering, urban planning, commerce and political science, and are assigned roles so as to maximize the opportunity for interdisciplinary experience. The faculty is also interdisciplinary.

Achievements of Former Students

Ultimately the success of a program should be manifested in tangible ways. The College of Law derives satisfaction from the fact that former research associates and students who participated in the programs described in this paper hold a variety of responsible positions in the field of environmental law. Many are attorneys for the United States and Illinois Environmental Protection Agencies, and for other public agencies in this country and abroad whose efforts are directed at improvement of the physical environment, including the U.S. Department of Justice and the offices of the Attorneys General of Illinois and other states. Several are teaching at major law schools. Probably the largest number are in private law practice, representing clients ranging from conservation organizations to major polluters. Some have joined the legal staffs of industrial corporations at least partly because they believe, correctly, that concerned attorneys in such positions can be critically important in developing within the business community a sympathetic attitude toward environmental protection and compliance with related laws and regulations.

The Future of the Programs

The need for research and training programs in environmental law continues to grow. The subject is becoming increasingly complex and controversial. Economic recession and the energy crisis have forced hard looks at the benefits and costs of environmental standards and at the economic and technical feasibility of compliance measures. The interrelationships between land use and pollution controls, and the need for resolution of conflicts among different federal, state and local governmental agencies which impose such controls, become clearer every day. The desire for better results is tempered by reservations about greater public regulation of private activities. Environmentalists as well as industrialists question whether direct regulation is the answer and look more favorably at innovative alternatives such as effluent changes.

The University of Illinois College of Law will continue to respond to these challenges. Research efforts and course offerings will be expanded to meet the new needs and the desire of even more students to study and assist in the solution of some of our society's most difficult problems.

MAN-ENVIRONMENT STUDIES PROGRAM: UNIVERSITY OF WATERLOO, ONTARIO, CANADA

by G. R. Francis*

The Waterloo Man-Environment Studies, dating from 1969, is based in a custom-built unit within a Faculty of Environmental Studies, which in turn represents an amalgam of a School of Architecture, a School of Urban and Regional Planning, and a Department of Geography. The Program offers a bachelor's degree in environmental studies, its rationale that "it gives students an opportunity first to survey the range and scope of environmental issues, receive an orientation deemed appropriate for addressing them, and then from the many possibilities select a preferred direction for more concentrated work in related substantive fields." The Program's 12-member staff is characterized as a multidisciplinary faculty working with a transdisciplinary curriculum. The author presents a frank and fascinating account of how the Program has adapted to a changing institutional and social environment, and concludes with a challenging question: "Can university programs of environmental education survive growing campus constraints and conventions?"

Introduction

Man-environment studies was created at Waterloo in 1969 as a four-year undergraduate program leading to an honours Bachelor of Environmental Studies (B.E.S.) degree. The program was given its own administrative base and autonomy in a separate Department of Man-Environment Studies. This Department was a new unit within a Faculty of Environmental Studies established at the same time. The Faculty brought together, administratively, a professional School of Architecture, a professional School of Urban and Regional Planning, and a Department of Geography.

It was envisaged at the time that out of this new grouping a strong environmental education thrust would emerge as an integral feature in all programs of the different units. The Department of Man-Environment Studies was to be a major contributor and participant in this larger effort at the same time it was to develop and offer the new four-year

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program. For reasons suggested later, the common thrust in the Faculty itself did not materialize, although informal cross-unit cooperation appears to be increasing within the Faculty.

The introduction of environmental education by Waterloo at the undergraduate level, rather than the graduate level, was a quite deliberate decision. It had been a point of discussion among academics at the time. The argument in favour of the graduate option was that students should, and probably would want to, get a good background in one of the traditional mono-disciplines or mono-professions first, then seek a broader context of understanding within which to apply their discipline or profession to environmental problems. Conversely, the argument in favour of an undergraduate approach was that it gives students an opportunity first to survey the range and scope of environmental issues, receive an orientation deemed appropriate for addressing them, then from the many possibilities select their own preferred direction for more concentrated work in related substantive fields.

Clearly, students have responded to both approaches, and it is important only that both are provided by a system of post-secondary institutions. The Waterloo program still reflects the earliest and most substantial commitment to undergraduate environmental education in Canada. However, two or three other universities now offer majors in environmental studies which students earn by taking a prescribed number of courses from among an array taught by different university departments for various other purposes. For the graduate level option, at least three Canadian universities, although not the University of Waterloo, have Master's degree programs in environmental studies.

An Overview of Man-Environment Studies

Descriptive accounts of the man-environment studies program reviewing its aims, origin, rationale, organization and approaches to teaching and learning have been published previously.[1] Therefore this article will touch only on the main features of the program and give more updated information on some of its results. The program itself has also experienced the need to adapt to a changing institutional and social environment over the eight years since it began. Some of the issues this posed are also discussed.

The educational aims of man-environment studies are essentially those noted above as a rationale for the undergraduate approach. As it entered its ninth academic year in the autumn of 1977, man-environment studies has a full-time teaching faculty equivalent of 12 persons who collectively represent a wide range of disciplinary backgrounds and prior working experience. This multidisciplinary mix includes persons with academic qualifications from different biophysical and social science disciplines as well as from applied fields such as communications studies, engineering, law and nutrition. Other useful background experience has been brought to the program by faculty who have also worked in government, industry, international agencies, and community organizations. The continuing outside involvement of faculty in research, consulting and public interest citizen's groups helps to maintain the infusion of new experience and material into the program.

Some 250 students are enrolled in the four-year program. This can be compared with a total university enrollment of about 13,000 students. While there have always been more applications for admission than can be accepted, there is still a rather variable pattern of enrollment and attrition. Generally, the program counts on admitting from 60 to 70 students in Year 1 and graduating about 25 from Year 4. In practice, Year 1 enrollments may run much higher, but the attrition rate is also higher in the first two years. While this phenomenon is not as well understood as it should be, it seems clear that a number of students are attracted to the program because of the flexibility it allows them to explore options within the university. A few will then transfer to other programs to pursue particular subjects of interest. Some decide against further university work itself, in part because they find the uncertainty and ambiguity of relatively loose course structuring and a high expectation for self-directed learning too difficult to manage. And some just do not meet what is expected of them in the program.

The curriculum requires completion of 22 full (two semester) courses or the equivalent. Of these, about half are specified by the Department, mainly for the first two years. The core of the curriculum is the requirement that students complete successfully some environmentally-oriented project each year. This reflects a strong belief in the value of project-oriented learning. In Year 1, this is backed up by requirements to complete an introductory survey course on environmental problems and issues, and a set of "skills" workshops which introduce methods for obtaining and interpreting information. In Year 2, students are required to complete a course in ecology, one in the social sciences, and one in statistics or other data-information processing techniques. In the fourth year, they also enroll in a senior honours seminar.

The remainder of the program consists of free electives for the students. They can choose courses from anywhere in the university or even from nearby neighbouring universities. Electives begin in Year 1 and increase in succeeding years. This curriculum pattern allows students to arrange their programs to mesh with the curricula of other departments which typically increase the proportion of required courses in upper years. The Department itself also offers elective courses.

The students have three main program options. If they so wish, they can study whatever else is of personal interest to them and receive a highly individualized mix of subjects and skills. They can also pursue a sequence of courses in some discipline, or a set of courses in a particular field such as natural resources. Or they can try for a combined honours degree. For this last option, arrangements have been negotiated with 12 other departments in the university. By devoting electives properly, students can complete the honours requirements of one of these other departments. Thus they can combine environmental studies with quite concentrated work in one of the traditional disciplines from the bio-physical sciences, mathematics, social sciences and humanities, as well as with either of two other multidisciplinary programs in recreation and health and human kinetics. This is not an arrangement however, which can be made easily with professional schools. It means only that students who wish to combine say, a degree program in engineering with environmental studies are advised to do their first degree in engineering, then pursue options for environmental studies at the graduate level.

A variety of approaches have been utilized in teaching and learning, at least to the extent these can be adopted within the constraints of the institutionalized structure of a university. They have included team and shared teaching, a considerable reliance on workshops and small group sessions, field trips and attendance at conferences, and the involvement of students in on-going community programs and local environmental issues. Students have also been encouraged to present their individual or group project results in formats other than a standard paper or report. These have included film and other audio-visual presentations, articles for the media, briefs for presentation at public hearings, and teaching materials for use by community groups.

As one of the first of the university-based environmental studies programs, man-environment studies attracts regular interest in what happens to the graduates who go forth from it. Of the 120 or so persons who had graduated by the spring of 1977, the whereabouts and current commitments of 93 were recently tallied. Thirty-seven had gone on for graduate studies, mainly at other universities in Canada, and of these, 28 had enrolled for graduate work immediately after the completion of their B.E.S. degree. Twenty-five were employed by government agencies. Sixteen of these went to various Ministries of the Ontario provincial government, while the others are with federal, municipal or other provincial governments. Another 18 are in the private sector, mainly with businesses or consulting firms, although a few are self-employed. Finally, 13 are employed for community service work either in citizen organizations or with government-supported health, education, or social services. In the last two or three years students have experienced greater difficulty in finding employment to match their interests. Their problem in this regard seems to be no more severe than that of most other young people graduating with Baccalaureate degrees, given current economic conditions and the negative impact on jobs from the curtailment of government spending.

The students who pursued graduate study have entered a wide range of fields. Altogether, the 37 who went on the graduate school enrolled in 28 different programs of 16 universities in North America. Most enrolled in programs which give professional qualifications at the graduate level and are open to students with different prior academic backgrounds. Included are fields such as law, business administration, natural resource planning and management, urban studies and urban planning, environmental design, teacher training, and social work. However, some entered fields where entrance requirements for graduate work are defined more narrowly, as for example, environmental engineering, systems design, landscape architecture, environmental science, biology, geography and sociology. Basically, the field entered depended on what else the students had elected to study along with environmental studies in their undergraduate years. The combined honours arrangements have been helpful here.

It remains to be seen whether students who pursue their higher education in part through programs like man-environment studies will eventually contribute to society in ways significantly different from what others do and they especially might otherwise have done. An attempt to evaluate the effectiveness of environmental education in these terms would pose considerable difficulties indeed.

There is nevertheless a related question about what the students themselves find of more lasting worth. Informal discussions on this have been held from time to time with some graduates to solicit their reflections on the program once they have been away from it for two or three years. This is clearly a biased sample. It draws from those sufficiently satisfied with the experience to keep in regular touch after they leave. But by and large, they testify in favour of the value of project-oriented learning as being highly appropriate for the kind of job assignments they receive. Their learning to come to terms personally with the ambiguity and uncertainty inherent in a more unstructured and self-directed learning situation is also a strength for a number of job situations they encounter.

The main weakness felt by some was insufficient background on substantive questions they have subsequently encountered in their work. Students either could not or did not anticipate their future involvements while in university to the point of selecting elective courses which, as it turned out, could have been of help to them. There has been no "consensus" whatever on these gaps to allow a convincing case to be made that henceforth all students in the program must take this or that other course. This is not surprising given the range of employment students have entered. Instead the program continues to rely on the expectation that with enough experience in self-directed learning, students will find ways of continuing their learning in other areas when the need and motivation arises.

Adapting to a Changing Environment

Like other university-based environmental education programs, man-environment studies was created when an "environmental crisis" movement was running high in North America and Europe, when post-secondary educational institutions and alternatives were being expanded as a matter of firm government policy, and when university-age students were actively challenging the relevancy or even the legitimacy of much that was being done by established institutions. At universities they demanded alternatives to highly-structured traditional programs detached from the social concerns of the day. Newer universities such as Waterloo which itself was created only in 1959 were among the first to respond with degree programs in environmental studies.

Now, less than ten years later, apocalyptic environmentalism has faded well into the background, energy and chronic economic recession are currently on center stage, educational spending at all levels is firmly held down and across-the-board unemployment among college and universities graduates is becoming the prime concern of students. "Environment" itself has also become institutionalized. This is particularly so within government, but also within the schools and in some post-secondary institutions. Controversies over feared environmental consequences of development schemes are a regular event across Canada, as elsewhere, and attempts are being made to reconcile conflicting arguments through application of environmental impact assessment policies and procedures. This means that "environment" for many people, including students entering university, now seems something quite familiar, even if it is not always well understood.

Three kinds of program adaptations have thus had to be made. One was to the increasing budget stringencies, another was to the changing mood and expectations of students, and the third was to developments within the environmental studies field itself. Of these, the most continuously felt pressure came with the rapid levelling off, then virtual freezing of university budgets in Ontario in the early to mid-1970's. For new programs then just getting underway, this rapidly curtailed growth. However, in itself this was not viewed too negatively within man-environment studies. It helped reinforce a strong view that the teaching and learning ideals of environmental education can only be met effectively through small-scale endeavours. Budget stringency did preclude developing a general degree and Master's degree program at one time contemplated for the Department, but this caused no lasting concern.

The more serious problems associated with budget limitations have been the impacts on teaching styles and on the cooperative relationships among faculty and between programs. Within man-environment studies, it has become increasingly difficult to sustain an informal, open-ended and student-oriented approach which reflects the very essence of environmental education. Budget limitations combined with rising fixed costs in salaries have steadily reduced operating funds. This has meant fewer teaching assistants and the occasional non-replacement of faculty who leave. Budget restrictions have also led to the elimination of class projects away from the university and severe cuts in field trips. Team teaching is seen increasingly as just too expensive in faculty time. Administrative recognition of teaching loads makes no real allowances for the time expended in multiple small groups, team-teaching or even shared teaching, and giving individual guidance to students for projects. As long as faculty morale remains high, there can be a carry-on-regardless spirit, sustained largely by satisfying relations among one another and with students. However, over the long haul an insidious, wearing down process has become evident. A high level of devotion to environmental education is also threatened whenever a university tenure decision makes it clear that academic tradition deems it of little significance.

In terms of cooperative relations, these trends work against the kind of faculty learning, un-learning and re-learning so essential for developing a measure of true interdisciplinarity. It is basically a question of time and other day-to-day commitments rather than intent. Man-environment studies, for example, is still best characterized as a program offered by a multidisciplinary teaching faculty working with a transdisciplinary curriculum. An interdisciplinary core, in the most strict academic sense, has just not been developed within the program.

In the Faculty of Environmental Studies itself, the environmental education thrust originally envisaged never evolved. In large measure it can be attributed to the increasing pre-occupation of each administrative unit with maintaining its own program commitments; with pressures placed on faculty to concentrate foremost on those activities which further their individual academic careers; and the need also for them to adapt to increasing teaching responsibilities occasioned by reduced operating funds. This, along with mixed views and scepticism about environmental education itself among some discipline-bound faculty, relegated any question of a new thrust to intermittent discussion in committees. However, one can still wonder if it may yet come to pass. If so, it will happen not by a relatively easy-going togetherness of teaching faculty with overlapping interests as was once thought, but by the sheer need to combine talent to maintain programs under a continuing budget squeeze.

Man-environment studies has also had to respond to marked changes in the attitudes, prior knowledge and expectations held by students entering the program. While there is still the expected wide variety of interests, fewer students are looking as others once did to "environment" as the basis for a social movement to challenge established institutions and established ways of doing things. Instead they are inclined to view it as a possibility for rewarding career opportunities or in some cases as merely one way to find a "job". Those interested in alternative life styles are more likely now to be seeking ways to develop greater self-reliance in a home or community setting. They may retain a general commitment to participate in the larger society around them, but wish to do so much more on their own terms. Few wish to "drop-out" altogether, as was once the ideal of a distinct minority. The latter were often attracted to man-environment studies in its early years but few completed the program.

The now greater familiarity of "environment" also means in part that more students feel they already "know about environment" and want instead to learn how to resolve problems. Some have in fact had a good introduction to environmental studies from enterprising secondary school teachers, or from experiences in alternative schools.

The net result of these changes in the in-coming students has been a need to modify courses to stress problem-solving aspects even more, and strengthen workshop offerings in approaches and methods. There is a growing feeling among some faculty that yet more emphasis will have to be placed on the institutional bases of environmental issues, on basic questions of management, and on examining in more detail alternative strategies put forward for achieving environmentally-sustainable societies.

Concluding Comment

In looking back over the first eight years of the program, teaching faculty share a large measure of satisfaction in what they and students have been able to achieve. The program was created in the enthusiasm of the times, it had more than a fair share of academic scepticism and scorn in its earlier days, and it had to develop as best it could under shifting external circumstances and constraints quite unanticipated at the beginning. Whatever acceptance it now enjoys in its academic setting is owed in very large measure to the significant number of students attracted to the idea of environmental education, yet able to perform well in other academic areas.

Still, there can be no grounds for complacency. Much has yet to be learned about how more students can benefit from environmental education processes more effectively. Course material has constantly to be up-dated and revised, especially now that environmental studies as a field of inquiry has become accepted and rooted more firmly in the sciences and in social institutions.

Environmental education itself has to go beyond merely publicizing each "crisis" as it comes along. The challenge now is to conduct more searching inquiry into common institutional roots, necessary change and viable alternatives. And above all, university programs of environmental education have to guard against the prospect of being transformed by the growing constraints and entrenched convention within the very institutions housing them. They must not themselves become new expressions of the educational problems environmental education was meant to overcome.

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STATE UNIVERSITY OF NEW YORK COLLEGE OF ENVIRONMENTAL SCIENCE AND FORESTRY AT SYRACUSE

by Robert E. Frey*

The immense size and complexity of postsecondary education in the State of New York, both public and independent, sometimes puzzles those within the State, as well as those from other states. How, for example, could a specialized unit of the State University, The College of Environmental Science and Forestry, share so many collaborative and integrative academic and research programs with a major independent institution, Syracuse University? What were the historical conditions which led up to this most unique relationship? In this fascinating case study, the author describes the academic, research and public service programs of the College which has the largest fully used-campus in the world—over 25,000 acres!

This article describes the rechartering of the College in 1972, and also how a recent realignment of its graduate programs and a most dramatic and innovative shift to an upper-division/graduate center all interact to prepare the College to realize its highest potentials during the next decade. All told, SUNY-ESF at Syracuse is indeed, because of its excellence in instruction, research and public services, and its unique relationship with Syracuse University, a unique institution which epitomizes the American university response, not only in name, but in mission, to "the quiet crisis."

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The State University of New York College of Environmental Science and Forestry (ESF) is a unique, specialized institution which is part of the largest university in the United States. This uniqueness is not only derived from the fact it is the only institution in the United States completely dedicated to instruction, research, and public service in environmental science, but also its very organizational structure and historical ties mark it as a link between a large state university and a major independent university.

This paper will describe in some detail how the College of Environmental Science and Forestry evolved into the particularly unique institution it is today and what changes are now taking place to insure its vitality and continued contributions to society.

Early History

The first college of forestry in this country was established at Cornell University in 1898. That college enjoyed brilliant leadership through its first director, Dr. Bernhard E. Fernow. A dramatic innovation in the second year of operations of the Cornell College of Forestry was the transfer of juniors and seniors to a 30,000-acre college forest in the Adirondacks where critical field experience was provided. Dr. Fernow introduced students to many experimental management practices including clear-cutting and surface-burning. Such practices have always been controversial in professional forestry but were anathema to those wealthy land holders who had taken up summer residence in adjacent areas in the Adirondack mountains. Many property owners complained that their holdings were being depreciated greatly by the methods demonstrated by Dr. Fernow's staff and students. The short life of the Cornell College of Forestry was brought to an abrupt end in 1903 by the cessations of fiscal support through action of the Legislature in response to complaints of the College's Adirondack neighbors.

Meanwhile, a group of citizens in the Syracuse area, influenced largely by Chancellor James Roscoe Day of Syracuse University, concluded that a professional school of forestry was a requirement for New York State, and concluded, also, that it would be greatly to the advantage of Syracuse University to have the school located on the Syracuse campus. After extensive political negotiations, their efforts culminated in the establishment of the New York State College of Forestry at Syracuse University in 1911. There has been much argument about the meaning of the entitlement; but there is abundant evidence that the words "at Syracuse University": simply were meant to convey the fact that the new College of Forestry was not to be located at Cornell University.

This legislative action was especially significant in two important regards. In the first place, training in the profession of forestry was "liberated" from the context of general agriculture. For many years, the New York State College of Forestry was the only major school of forestry operated as a separate entity from a college of agriculture. A second major significance lay in the establishment of a foundation for a unique design of institutional cooperation between a public institution and a large independent university.

ESF and Syracuse University

There were no clear legal definitions to provide for relationship between Syracuse University and the College of Forestry. Most of the relationship developed on a purely pragmatic basis as dictated by year-to-year operational concerns of both institutions.

Although from its inception the New York State College of Forestry has been supported wholly from State operations funding, it has been considered by many to be one of the schools that composed the complex pattern of organization of Syracuse University. There is, however, no legal basis for this view since Syracuse University has never had any formal, legal obligation to the State of New York through the New York State College of Forestry. The unique cooperative arrangements that developed over 66 years between the two institutions have contributed heavily to the ambiguity, but, perhaps ironically, have also strengthened the College's fine character.

The College of Environmental Science and Forestry has built no dormitories at its Syracuse campus, has no dining facilities, has no College infirmary, no athletic facilities, does not operate any student union facility, does not maintain a steam plant, has no independent commencement exercises, has no bookstore, nor has it ever established a number of educational services that are common to most units of any state or private system. During the past ten years alone, if New York State had provided the services supplied to the College by Syracuse University, and built facilities to house them, it would have been at a total expense to New York State approaching $40,000,000. Notwithstanding, Syracuse University has provided such services and facilities in the past ten years to New York State through the College at a minimum cost to the State.

Another extraordinary manifestation of institutional relationship becomes apparent in commencement celebrations. During its entire history, every graduate of the College, whether upon the occasion of his being awarded a Baccalaureate, Master's, or Ph.D. degree, has received two diplomas, one from the State University of New York's College and one from Syracuse University. Indeed, the commencement exercises are held jointly, and the two diplomas (degrees) are awarded simultaneously. Thus, every degree program at the Syracuse campus of this College, in a technical sense, has been a joint degree program with a distinguished private university. The tremendous advantages to those receiving such degrees are obvious.

One other historical fact that is of enormous significance to the College lies in the accumulation over the years of magnificent "off campus" program areas located in various parts of the State with a total acreage in excess of 25,000. Each of these "campuses" is unique in its physical characteristics. Together they provide an array of research, training, and public service facilities probably unmatched in any other educational institution across the country. But most of such properties were given "to Syracuse University . . . to hold in trust for the College." Thus, the College has become a public institution with a major portion of its facilities and services deriving from private sources.

Mission

From 1911 when Governor John A. Dix signed a bill establishing the New York State College of Forestry at Syracuse University until today, the College has had a well-focused mission orientation. The legislative act which created the College of Forestry instructed that the institution "conduct such special research in Statewide investigations in forestry as will throw light upon and help in the solution of forestry problems . . ." and that it be "the institution for educational work in forestry in the State."

Though the mission prescribed in the 1911 statute was specific, it left the College with flexibility to broaden its scope beyond the boundaries of pure "dirt forestry" to include a number of critical substantive support areas. Forestry, narrowly conceived or broadly, does not and cannot survive in a vacuum. Thus, strong programs in design (landscape architecture) engineering, management, and the basic sciences emerged very early in the College's development. In each of these areas a highly sophisticated, specialized, and senior staff was assembled to accommodate far more thoroughly its approach to forestry and environmental science than was possible in any other college of forestry in the world. But with its roots firmly planted in the fertile soil of forestry, it remained an exceptionally specialized institution. For over 60 years, the full thrust of the College has been focused on the environment as it has related to forestry, on all of its campuses and in each of its three mission areas — instruction, research, and public service.

This specialized mission for the College was supported by the various University of New York Master Plans. In 1972, the full breadth of the mission was formalized by the College of Forestry being rechartered as the State University of New York College of Environmental Science and Forestry.

This broader mission emphasis is expressed by the following excerpts from New York State Education Law, Article 121:

The college (ESF) shall have as its objects and purposes:

1. Teaching in the science and practice of environmental science and forestry in its several branches including landscape architecture; environmental design; environmental and resource engineering; environmental and resource management; wildlife studies; biology, chemistry, ecology; the manufacture and marketing of forestry products; and the technologies appropriate to these branches of environmental science and forestry.

2. The conduct of research, investigation, and experimentation relating to such studies wherever appropriate, including suburban or urban areas, and in commercial or industrial facilities.

3. The conduct of experiments in forest and related resource development and management for public, commercial, recreational and aesthetic purposes, and generally, the giving of popular instruction and information concerning the elements of environmental science and forestry.

4. The operation of demonstration and public service programs with a view to acquiring, transmitting, and applying knowledge concerning the scientific management and use of forest and related natural resources for human benefit.

This broadened mission, which ESF continues to embrace, provides an exciting challenge for the College to focus its broad and deep resources on issues and problems with which the State, the nation, and, indeed, the world now grapple. Through its engineering, chemistry, biology, environmental science, resource policy, and landscape architecture programs, each of which supports the others, the College is constantly seeking more efficient and effective modes of operation to maximize the synergism necessary to solve increasingly complex problems.

Programmatic Changes

Two strategies have recently been implemented which will enable the College to use its resources to achieve its mission more precisely and effectively. The first, which went into effect May 11, 1977, is a consolidation of the graduate programs from 13 to seven. This change will accommodate and encourage a more cohesive programmatic approach with better cross-program participation and collaboration by faculty and graduate students.

Recognizing that the College has never been charged either in its original charger or in its current mandate with the responsibility of delivering lower-division "general" studies, a second strategy is a transition at the undergraduate level from a lower and upper-division program to an upper-division undergraduate design. The shift will allow better utilization of accessory instruction resources at Syracuse University for upper-division and graduate students. This transition will occur over a three-year period, beginning in the Fall of 1977, and will provide for an orderly change from accepting high school seniors directly into ESF to accepting only transfer students from two-year colleges and four-year colleges who would enter at the junior level. A well-defined plan to adjust the curriculum, where necessary, and link it to other colleges has been developed. At the upper-division level, ESF will emphasize those courses and programs not available elsewhere in the State and build on a partially prescribed educational foundation obtained by students at other institutions.

The following table presents the undergraduate and graduate program available at ESF:

Schools at ESF	Program	Degree-Programs
Biology, Chemistry & Ecology	Environmental & Forest Biology	B.S., M.S., Ph.D.
	Chemistry	B.S., M.S., Ph.D.
Environmental & Resource Management	Resource Management and Policy	B.S., M.S., Ph.D.
	Silviculture and Forest Influences	M.S., Ph.D.
Environmental & Resource Engineering	Environmental & Resource Engineering	M.S., Ph.D.
	Forest Engineering	B.S.
	Paper Science & Engineering	B.S.
	Wood Products Engineering	B.S.
Forest Technology	Forest Technology	A.A.S.
Landscape Architecture	Landscape Architecture	B.S., B.L.A., M.L.A.
College-Wide Interdisciplinary	Environmental Science	M.S., Ph.D.

The College-wide, interdisciplinary program in environmental science presents an opportunity for graduate students to pursue a holistic education which cuts across the more traditional departmental approach. Students take courses from throughout the College and from among the physical, earth, and biological sciences, the social and applied sciences, and the quantification and analytical sciences. Resources from Syracuse University such as communications, policy analysis, law, sociology, political science and public administration are also widely used in this program.

Along with these wide-ranging course selections, students choose an area of study from among environmental education/communication, water resources, environmental assessment and impact, land use planning, or policy and programming. This chosen area of study provides the student with a specific orientation in his program which serves as a focal point for career development.

Research

Research at ESF is an integral and vital part of the total educational mission. Most realistically, research is juxtaposed between instruction and outreach activities, thus contributing to and strengthening the other mission areas.

Specific research program goals are: (1) to advance knowledge of man's environment, his natural resources, and the reciprocal relationships among man, his environment, and his resources for the betterment of society in the state, the nation, the world; (2) to pursue the advancement of knowledge vigorously and objectively through research ranging from immediately relevant (applied) studies through long-range basic research, and through a balanced program of disciplinary, multidisciplinary and transdisciplinary studies; (3) to provide valuable experience for faculty and students, especially graduate students, toward the end of improved education for environmental and resource scientists and practitioners; (4) to serve as a strong and continuous tie between ESF's instructional and outreach programs; and (5) to serve a broad array of clientele, e.g., local, county, state and federal government; citizen's groups; commerce and industry; and the more general publics.

The substance of the College's research program derives from all of the research institutes and centers, academic schools, and from activities on the six campuses, each of which has established the cooperators which add to the force of the combination.

The overall research cooperative effort now includes agents of the National Science Foundation, the Federal Government's Council on Environmental Quality, the Environmental Protection Agency, the U.S. Forest Service, the Pinchot Institute, the Upstate Medical Center, the Univeristy Centers of SUNY, Syracuse University, Cornell University, over two dozen major universities outside New York State, the research staff and administration of over fifty foreign and domestic firms in the paper and allied industries, five professional and scientific societies, and the State agency research centers. The in-house scientists and faculty number approximately 150 with five times that number among the cooperators.

The broad potential of this group provides for environmental science and forestry research capability unmatched anywhere. But the most compelling part of the plan is the integration of the research design with critical objectives for education and public service. Each of the triad is programmed in consideration of the objectives and priorities of the other two. Thus, each strengthens the others in a purposeful way. The College, with the help of State University, is now building the research arm to the highest echelon in its field. By moving quickly to build the remainder of the capability required, State University can confidently expect its national leadership to result in substantial extramural funding from environmental science.

Public Service

The outreach programs of the College flow naturally from its instructional and research missions. The overall goal of outreach endeavors is to provide maximum service to a broad array of publics. Thus, outreach programs are designed to serve non-matriculated students, groups of professionals, all levels of government, associated commerce and industry, public interest groups, etc. Outreach activities generally are grouped into five overlapping categories: (1) continuing education, (2) information and demonstration, (3) technology transfer, (4) governmental service, and (5) industrial development.

Continuing education at ESF follows three major thrusts: (1) short courses for groups of professionals; (2) regularly scheduled classes for non-matriculated students drawn from various publics; and (3) conferences, symposia, seminars, and forums directed toward appropriate combinations of professionals and laymen. The specific goal of these activities is to provide continuing opportunities for exchange of current and cogent information which will allow professionals and citizens at large to improve their performance and increase their contributions to human welfare.

These activities, coupled with the College's information and demonstration efforts, include, for example, the areas of land use planning and management, water resources management, urban physical environments, energy conservation systems, and related remote sensing and environmental monitoring systems. Information from these and other topical areas is transmitted by several devices, including the United Nations Environmental Program International Referral System. The major objective of these activities is to provide specific and timely information to organized publics upon request.

Technology transfer occurs across all outreach activities, but is central to collaboration with local, county, regional and state agencies and commissions, and to a variety of production and processing industries.

Service to government also includes participation in a variety of projects. These projects often produce a melding of applied research and the transfer of existing technology.

The Institute of Environmental Program Affairs (IEPA) draws upon appropriate faculty and research personnel from across the College to address pressing environmental problems as perceived by governmental agencies, industry, citizen groups, etc. IEPA projects are usually problem-oriented, coupling applied research effectively with the extension of information. The College's Applied Forestry Research Institute (AFRI) conducts applied studies for federal and state agencies and for the forest and wood-using industries. Research implementation activities form an important part of AFRI's program. The Empire State Paper Research Institute conducts both basic and applied research in paper science and engineering and serves as a teaching source of technical information for the world's pulp and paper industries. Additional natural material and products research is conducted by the College's Polymer Research Center and the Nelson C. Brown Laboratory for Ultrastructure Studies. These units are world-renowned for their studies in paper technology, polymer chemistry, and ultrastructure. The College's Adirondack Ecological Center serves northern New York State through its studies of Adirondack ecology with particular emphasis on forest land and wildlife management. The extension of the results of this research contributes greatly to natural resource management policies and practices in New York and the Northeast.

ESF's institutes and centers contribute to the College's overall mission both catalytically and synergistically. Their programs attract, for example, over 40 percent of the College's extramural funds, which often include seed monies for younger faculty and support for graduate students. Faculty and students from several schools and departments are frequently engaged in transdisciplinary institute and center projects. Most of these projects provide both intellectual and operational stimulation to number of students, young faculty, and established investigators, as well as providing valuable services to clientele. These efforts interact to make the College's total contribution far more than the simple sum of its constituent parts.

Summary

Indeed, ESF is a unique institution which has responded well and will continue to respond to the needs expressed by the complex issues which surround our physical environment.

Future efforts will be toward strengthening and expanding the efforts necessary to pursue effectively the complex mission of instruction, research, and public service in environmental science. These resources would be most productive if used to establish a nationally recognized and supported program for educating environmental scientists, conducting research on pressing environmental problems, and providing greatly expanded effort in outreach activities.

CONSERVATION OF NATURAL RESOURCES FIELD MAJOR: UNIVERSITY OF CALIFORNIA—BERKELEY

by Paul L. Gersper*

As in the case of the blind men and the elephant, describing environmental studies in a multiversity like UC-Berkeley depends on whether you are touching the trunk, a leg, or the tail. Elsewhere in this compendium is a case study of Berkeley's unique Energy and Resources Group. If the chairmen of a dozen other configurations at Berkeley were to respond, each would picture environmental studies in a somewhat different way. Here, for example, is the story of Berkeley's interdisciplinary undergraduate major in conservation of natural resources, offered by the Department of Conservation and Resource Studies in the multi-faceted College of Natural Resources. The program represents an "ecological" approach to "issues and areas of interaction among natural resources, population, technology, societal institutions, and cultural values." In some ways the program defies the laws of gravity. In its eight years of existence it has had to surmount intense student unrest, ever-increasing fiscal austerity, key personnel changes in system administration, and traumatic campus reorganizations, not to mention the inherent difficulty of conducting a major without any faculty assigned to it. But survive the program has, and now its chairman is looking confidently to a future that will hold the extrapolation of the CNR major into a graduate program with multidisciplinary research possibilities. As a guide to avoiding failures and exploiting successes, this summary is extremely revealing.

Introduction

The Conservation of Natural Resources (CNR) field major observed its eighth birthday on January 1, 1978. The program had an inauspicious beginning during a period of extreme campus unrest and in an era of ever-increasing austerity and declining credibility of the University. First steps in establishing the major were taken early in the 1969-70 academic year by approximately 100 students and a small group of dedicated faculty volunteers, with no separate funding. Throughout its

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eight years of existence, the major has struggled against severe difficulties: budgetary uncertainties, changes in key administrative personnel, and an extensive campus reorganization—including development of the new College of Natural Resources from elements of the College of Agricultural Sciences and the School of Forestry and Conservation. Prior to July 1, 1974, there was also the inherent difficulty of administering a non-departmental program, and, throughout the entire eight years, the difficulty of administering a large academic program without specific faculty assignments to it.

Regardless of the difficulties, the major grew steadily, without fanfare, in enrollment, strength, and reputation, over the eight years. The number of students in the major increased from the original 100 in 1970 to a peak of about 450 in 1976, and then dropped, because of an imposed enrollment limitation, to the current level of approximately 350 students. The major now has 676 alumni, which will increase to approximately 830 by the end of the 1977-78 academic year. The ability of its alumni to gain significant employment and admission to graduate and professional school degree programs has attested to the success of the major, and provided evidence that there is a need for innovative, interdisciplinary programs like the CNR major on university and college campuses. The major is still developing, and undoubtedly will be for some time, but it is now a well-established, respected major with ever-increasing potential for the future.

The development of the CNR major can be conveniently divided into five fairly distinct periods. The first is the formative time before the 1969-70 academic year when the seeds that eventually produced the major were being sown. The second covers the early days of the major, 1969-70 through 1971-72. The third, and perhaps the most critical, time-span, [illegible] the period of uncertainties, 1972-73 through 1973-74, during which the major could easily have sunk into oblivion but somehow survived. It was also during the period of uncertainties that a general formalization of the major began and its future course began to be charted. The fourth period covers the early days of the major within the newly created Department of Conservation and Resource Studies (CRS) and the College of Natural Resources. This was the period from 1974-75 through 1975-76 and was marked in the beginning on July 1, 1974, by CNR becoming a regular major on the campus. The fifth period, 1976-77 through the present, has been one of institutionalization in which support budgets, permanent faculty recruitments and appointments, and plans for graduate and research programs related to the major have been developing.

The Conservation of Natural Resources Field Major—A Description[1]

The major is an interdisciplinary program, offered within the Department of Conservation and Resource Studies. It has been molded around the developing philosophies and interests of the teaching faculty and the student enrollees. An underlying thought in the program is that problems caused by technology cannot necessarily be solved with more technology and most problems cannot be solved solely with science. Thus the CNR major, and later the PENR major,[2] were designed to avoid the purely technical or scientific approaches embodied in many of the multidisciplinary environmental or conservation programs at other institutions. The major is intended for students interested in the exploration of conservation and environmental issues and areas of interaction among natural resources, populations, technology, societal institutions, and cultural values. Its orientation is toward flexibility and innovation, and it is designed to provide a creative, individualized educational approach to understanding the structure and dynamic function of complex environmental systems within our society and biosphere.

In close consultation with their faculty advisors, CNR students build and synthesize individualized curricula of study utilizing the rich educational resources of the Berkeley campus as well as appropriate off-campus resources. With minimal restrictions, any course in the campus catalogue is appropriate as long as it can be defended as relevant to the student's particular area of interest. Taking advantage of only a few required courses, and with no constraints on electives except relevancy, most students put together combinations of courses that are usually more relevant for coming to grips with real-world problems than traditional programs designed to deal only with models of selected parts of the problems.

The major maintains an extensive, coordinated, personalized advising system emphasizing frequent and informal contact between faculty advisors and students. The advisors, who collectively possess a variety of professional backgrounds and personal environmental concerns, facilitate student access to the broad spectrum of knowledge available on and off campus.

A large number of faculty members from the departments of the College of Natural Resources and from other campus units participate in the CNR major as members of the teaching staff, major advisors, guest lecturers, seminar leaders, and internship supervisors. Many off-campus community resource people also participate, and the major encourages educational interaction between students and available community agencies and organizations. Part of this interaction is expressed by provision for educational services to the community through open lecture series, CNR involvement with the public school system, internships, and individual or group community projects.

This "real-world" perspective imparted by community interaction is characteristic of CNR. In keeping with this perspective, the curriculum is designed for flexible evolution in order to correspond to the realities of a rapidly changing world. Furthermore, the department maintains a large information file and a library covering a wide variety of current environmental and natural resource topics. Also, rapidly increasing facilities and services are available to assist students and to provide research and internship opportunities. Students are encouraged to make liberal use of available services and facilities, and to include independent studies and an internship in their individualized academic programs.

CNR students are urged to maintain a high level of extracurricular activities and to participate in the CNR student organization. They are also encouraged and afforded opportunities to contribute to the major and its programs through a wide variety of activities. A student-published newsletter, The CNR Review, keeps students and staff in close touch with student activities and with developments in the program.

Finally, CNR takes an ecological approach to the exploration of knowledge, an approach which draws on virtually every discipline in order to create an integral, dynamic view of contemporary reality. Students from many backgrounds and with diverse interests continue to find the ecological approach particularly meaningful and useful in the pursuit of their own personal, educational, and occupational objectives.

A summary of the plan of study and requirements for the major is as follows:

Freshman and Sophomore Years[3]	Units
Three quarter courses[4] in each of four of the five areas (12 courses): Biological Sciences, Physical Sciences, Social Sciences, Humanities, Mathematics and/or Statistics	36-60
Three additional quarter courses[4] in one of the four selected areas above	9-15
Two quarter courses[4] in reading and composition.	8-10
Three quarter courses in environmental issues (IDS 10A-10B-10C)	11-13
Introduction to Conservation of Natural Resources (CNR 49)	2
Junior and Senior Years	
Junior Seminar in Conservation of Natural Resources (CNR 109)	3
Ten quarter courses[4] (upper division) in the area of interest.	30-50
Senior Seminar in Conservation of Natural Resources (CNR 149)	4
Total units for four years of restricted courses	100-154
Unrestricted electives and University requirements	80- 26
Total Units	180

Courses

The department's Course Planning and Development Committee continuously reviews courses offered on the campus to insure that the educational needs of CNR students are provided to the greatest possible extent. New courses are proposed as needed and developed as major (CNR and PENR), departmental (CRS), or interdepartmental (IDS) offerings. Similarly, courses that are no longer needed are dropped. Moreover, all courses sponsored by the department are continuously reviewed for improvement and updating as needed. Students have a very active role in the deliberations of this committee.

The department provides courses of special interest not only to its majors but to students in other majors and those who simply want to sample the department "character." Most are open to majors and non-majors alike, although a few are restricted to majors only. However, CNR students are required to take only those department-sponsored courses that are specified under the plan of study and major requirements given above.

In order to provide additional insights into the character of the department and CNR major, the following listing of courses that are currently sponsored by the department is given:

Departmental Courses

CRS 23.	World Resources for Food and Agriculture. (3 units)
CRS 40.	Environmental Chemistry. (3 or 4 units)
CRS 40L.	Environmental Chemistry Laboratory. (2)
CRS 101.	Urban Garden Ecosystems. (5)
CRS 110.	Ecosystemology. (4)
CRS 115.	Environmental Philosophy and Ethics. (4)
CRS 118.	Linear Models of Natural Resource Problems. (3)
CRS 130.	Resource Development Law and Administration. (4)
CRS 131.	Environmental Law, Planning and Administration. (4)
CRS 132.	Environmental Impact Assessment. (4)
CRS 133.	Environmental Impact Reporting. (4)
CRS 140.	Economics of Land Use. (4)
CRS 150.	History of Resource Use in the United States from Colonial Times to Present. (4)
CRS 151.	Economic and Political History of Resources in Twentieth Century United States. (4)
CRS 160.	Economics of Food and Nutrition. (4)
CRS 161.	Agriculture in Economic Development. (4)
CRS 163.	Economic Analysis of World Agricultural Problems. (4)
CRS 170A-170B.	Sociology of Rural Development. (4-4)
CRS 180,	Internship in Conservation and Resource Studies (12 or 15)
CRS 191A.	Environmental Value Formation. (3)
CRS 191B.	Environmental Biology. (4)
CRS 191E.	Environment and the Media. (5)
CRS 191F.	Environmental Education. (4)
CRS 191G.	Directed Experience in Environmental Education. (2)

Interdepartmental Courses

IDS 10A. Introduction to Environmental Issues: Ecosystems, Their Maintenance and Disruption. (4 units)
IDS 10B. Introduction to Environmental Issues: Global Problems. (4)
IDS 10C. Introduction to Environmental Issues: The San Francisco Bay Area Environment. (4)
IDS 10L-10M-10N. Environmental Issues—Special Projects. (2-2-2)
IDS (Physics) 80. Introduction to Environmental Physics. (4)
IDS 120. Environmental Education and Design. (5)

Conservation of Natural Resources Major Courses

CNR 49. Introduction to Conservation of Natural Resources. (2)
CNR 99. Supervised Independent Study and Research. (1-5 units)
CNR 109. Junior Seminar in Conservation of Natural Resources. (3)
CNR 149. Senior Seminar in Conservation of Natural Resources. (4)
CNR 197. Field Study in Conservation of Natural Resources. (1-5)
CNR 198. Directed Group Studies for Advanced Undergraduates. (1-5)
CNR 199. Supervised Independent Study and Research. (1-5)

Political Economy of Natural Resources Major Courses

PENR 1. Introduction to Political Economy of Natural Resources. (4 units)
PENR 100A-100B-100C. Political Economy of Natural Resources. (5-5-5 units)
PENR 195A-195B-195C. Senior Research Project. (5-5-5 units)
PENR 197. Field Study in Political Economy of Natural Resources. (1-5 units)
PENR 198. Directed Group Studies for Advanced Undergraduates. (1-5)
PENR 199. Supervised Independent Study and Research. (1-5)

Career Opportunities

The department maintains a career opportunities service for its students. Postgraduate employment and educational opportunities for students in the CNR major depend largely on the student's area of interest. Although the general program is not designed to prepare students for specific employment opportunities, individual programs can be designed to assist the student toward specific career goals.

Graduates of the program, in some cases after further education, have gained employment in a wide range of fields. Alumni are currently at work as elementary, high school, and community college teachers, environmental specialists, environmental planners, city and regional planners, environmental impact specialists, attorneys, journalists, resource managers, research associates, farmers, Peace Corps volunteers, environmental consultants, businessmen, laboratory assistants, conservationists, writers, and environmental publication editors. Other jobs include environmental psychologists, organizational development consultant, city planning aides, soil scientists, public interest researchers, health counselors, youth counselor, physical therapist, carpenter, police officer, legislative aides, teachers of the handicapped, recreationists, park rangers, pathology assistant, veterinary assistant, and public policy specialists.

Many CNR alumni have gone on to graduate work in a number of fields including education (credential and Ph.D.), forestry, geography, landscape architecture, energy and resources, wildland resources, law, medicine, veterinary medicine, urban planning, public policy, public health, ecology, journalism, political science, and wildlife biology. Other fields include regional planning, biological control, creative writing, agricultural and resource economics, botany, business administration, entomology, soil science, economics, library science, nutrition, optometry, physical therapy, geology, dentistry, plant pathology, marine biology, zoology, and environmental planning.

Arriving at a clear understanding of the CNR major and its raison d'etre requires an historical review of its development.

The Period Before 1969-70[5]

Two themes pervade the subject matter and underlying philosophy of the CNR major and the CRS department: they are "conservation" and "environment." "Conservation" prevailed for a long time as a popular movement before its message was incorporated into academic and professional programs at universities and colleges. "Environment," on the other hand, began academically as ecology safely ensconced in university biology departments and then burst out into the popular environmental movement and reappeared in colleges in new and different forms.

There is a long history of instruction and research in conservation at Berkeley. More recently, in 1955 a Committee on Natural Resources was appointed by Chancellor Kerr to give advice concerning coordination of course offerings in the field of natural resources. This committee also concerned itself with facilitating and strengthening interdisciplinary research in this field. Efforts were made toward establishing an institute or center for natural resources on campus. Although for a number of reasons this was not accomplished, the Committee did sponsor and implement an interdisciplinary graduate level course on Natural Resource Ecosystems, listed as a School of Forestry offering, which is still taught today.[6]

Forestry at Berkeley was first a department under the College of Agriculture. In 1947 it became the School of Forestry, with an upper division professional program. In 1966 it became the School of Forestry and Conservation. At that time the character of the Forestry curriculum and the main interests of graduate and undergraduate students shifted from a predominantly timber orientation to a balance between conservation, timber, range wildlife, and recreation.

During the middle 1960's a group of ecologists at Berkeley began discussions leading toward a graduate group program in ecology. A similar endeavor was going on concurrently on the Davis campus. Included at Berkeley were ecologists from the departments of Botany, Zoology, Forestry and Conservation, Entomology, Sanitary Engineering, and Geography. The substance of the program would have had, essentially, a biological flavor. Before a satisfactory proposal could be developed, the "ecology movement" came along and the effort for a graduate group program in ecology was diverted towards a broader, interdisciplinary ("Whole Earth") program, including a much greater sector of the faculty as sponsors. It was at this point that many of the faculty members from the School of Forestry and Conservation and the College of Agricultural Sciences, who would eventually establish the CNR major, came together for the first time. The much expanded campus-wide group endeavoring to establish a broad-based, interdisciplinary program in ecology resulted in serious clashes of interest and the efforts were thwarted. Meanwhile, U.C.-Davis successfully effected an Institute of Ecology and a broad-based Graduate Group Program in Ecology.

Programs in Environmental Studies (or variously called Environmental Science, Environmental Education, Environmental Engineering, Man and His Environment, etc.) may be similar to conservation programs, yet all are more recent in origin. Most started in the wake of Rachael Carson's Silent Spring, near the end of the last decade. The foci of these curricula are varied, depending on departmental strengths and faculty interest at the various institutions. Environmental programs are not necessarily tied closely to the resource fields as are conservation programs, but nearly all stress interdisciplinarity and systemic viewpoints. They can be found at many institutions--big universities and tiny colleges--including the Berkeley, Davis, Los Angeles, Riverside, Santa Barbara, and Santa Cruz campuses of the University of California.

A review of many of these environmental programs has revealed that the motivation and timing of their establishment were similar to those of the CNR major, and that the CNR program includes elements in common with many such programs at other institutions. However, the establishment of CNR was also strongly influenced by the history of conservation programs, by the long history of instruction and research in conservation and ecology at Berkeley, by the fact that it came into existence on a campus noted for its high tolerance for innovation and experimentation, and especially because in the late 1960's there were large numbers of conscientious and astute members of the Berkeley faculty who were available and ready to develop and participate in such a program. This was particularly true in the College of Agricultural Sciences and the School of Forestry and Conservation. At about the time the establishment of a campus-wide, broad-based, interdisciplinary program in ecology was thwarted, participating faculty members from the College and School alternatively turned their full attention to the establishment of an interdisciplinary program to be co-sponsored by the two units.

Thus, in the spring quarter and summer of 1969, plans were made by the College and the School to form an environmental studies major (later called Conservation of Natural Resources) for undergraduates. At the same time, but independently, planning for a similar program was going on in the College of Letters and Sciences (to be called Environmental Studies). Drawing upon the momentum built up during the previous few years in the attempts to establish the broad-based graduate program in ecology, and taking advantage of the rapidly accelerating "environmental movement," Agricultural Sciences' plan was quickly expedited. It was launched by first developing and offering the IDS 10 course starting in fall quarter 1969. This three-quarter interdisciplinary course, then entitled "Man and His Environment--Crises and Conflicts," is still offered today for campus-wide enrollment as well as being a requirement for CNR majors, under the title "Introduction to Environmental Issues." The second phase of the plan was the accepting of approximately 100 students, for initial enrollment during winter quarter 1970, into the new Conservation of Natural Resources experimental field major.

From its beginning, CNR has consistently comprised about one-third of the total undergraduate enrollment of the college. The L&S program in Environmental Studies has been less ambitious in terms of numbers of students and new courses, but nevertheless it served and still serves a useful purpose in that college and for the campus.

The Early Days of the Major: 1969-70 through 1971-72

The basic framework and essence of the major as it exists today were well established during these first years. The founders and developers of the program and its early leaders were careful to establish a foundation for the major that provided assurance that it would retain its raison d'etre, flexibility and innovativeness with the passing of time: It was clear that to achieve such assurance would require care that the major would not, in time, become institutionalized along the lines of traditional academic majors and departments. It will be shown that the basic design of the major, reinforced by a lack of adequate budgetary and staff support, has so far allowed the major and the CRS Department to retain their purviews, flexibility and innovativeness, and have provided a foundation for them to continue to do so into the future.

During these first years the experimental major was co-sponsored by the College of Agricultural Sciences and the School of Forestry and Conservation. No faculty members, including the chairmen, were officially assigned (budgeted) to the major; and no base support budget, space and facilities, nor any nonacademic staff were provided. The number of students enrolled in the major doubled to 213 by spring quarter 1972, and a total of 85 students had graduated by the end of that quarter.

Most of the faculty participants in CNR during this time were volunteers from the departments of the College of Agricultural Sciences and from the School of Forestry and Conservation. These participants served as advisors, taught or helped teach the few courses in the program, and served on the program's committees. During the two and one-half years there were about 30 faculty members from the College and School who made significant contributions to the program, representing about 20 percent of the total faculty in the two units. Approximately 25 served as regular advisors. In addition there were more than 100 other members of the faculty, many from outside the College and School, and a similar number of off-campus contributors, who made smaller contributions to the program, usually through presenting lectures (mainly in the IDS 10 courses), participating in seminars and field trips, serving as information resources for students, or serving on ad hoc committees.

None of the major's faculty participants were given compensation nor release time from assignments and duties in their home departments, regardless of the level of their participation in CNR. In other words, they retained 100 percent appointments in their respective departments or schools and contributed to CNR from essentially their own free time. This is still the situation today; it has been a source of strength to the program as well as a source of many problems.

With no assigned base budget the program had to rely on support from salary savings and contributions generated within the College and School. These funds were highly uncertain and variable, and their volatile nature almost completely negated any long-range planning that depended on reasonably certain budgeting. In spite of this, the program was able to support, on a quarter-by-quarter basis, several part-time course assistant positions (mainly Teaching Associates in the IDS 10 courses), and small amounts of funds were made available to support course and course-related activities, including field trips. In addition, the program was also able to hire a secretary to run the single office which had to serve as the program office, chairman's office, course office, student affairs office, resource center, and base of operations for the Teaching Associates.

In addition to the three-quarter IDS 10 course sequence, a few more courses, all but one designed specifically for the CNR major, were developed and offered during this period. Thus, by the close of the 1971-72 academic year, the major was offering IDS 10A-10B-10C, IDS 120, and CNR 49, 149, 197, 198, and 199. Total course enrollments averaged approximately 1250 per year with 92 percent, in 1970-71, and 70 percent, in 1971-72, of the total enrollment due to the IDS 10 courses.

Advising was identified from the beginning to be the heart of the CNR major. It was clear that such a major with so few specific course requirements and with the onus on the student for planning and defending individualized programs of study, would require a cadre of able, well-informed advisors, representing many disciplines and interested in interdisciplinary education and research. It was also clear that faculty members from outside the College and School should be encouraged to join the advising staff if interested, in order to expand the interdisciplinary aspects of the program. Thus, the advising system was established with care, foresight and flexibility.

Advising in the CNR major[7] differs from that in most other majors in a number of ways: (1) each advisee develops and synthesizes an individualized, interdisciplinary program of study; (2) the advisee's individualized programs commonly range beyond the advisor's particular field(s) of expertise (although it is usually based within the advisor's field(s) of expertise); (3) the advisor must develop and maintain campus-wide familiarity with the general course catalogue, the faculty, departments, majors and programs, and facilities, and with off-campus resources; (4) the advisor must stay acquainted with a wide-ranging variety of employment opportunities and graduate academic and professional programs; (5) the advisor has the major responsibility in matters pertaining to the programs of study of her/his advisees; and (6) the advisor plays an active role in the overall affairs of the major including rotation on committees and in the required seminar courses.

Since advising in CNR is less mechanical than in most other undergraduate majors, considerably more time is required per advisee. Therefore, it was established from the beginning that advisors should normally carry a load of no more than eight advisees, and preferably fewer. At the same time a self-imposed enrollment ceiling was established to be eight times the number of advisors.

Students expressing an interest in the CNR major are asked to write an initial proposal which states their interests and educational and career goals, and also states how these interests and goals are better met in CNR than in other possible majors. Advanced sophomore and beginning junior students requesting admission are also asked to include a preliminary "area of interest" academic plan in their proposals. Each student is then interviewed and has her/his proposal evaluated by one of a group of CNR advisors serving as an admissions committee. During this interview the admissions advisor makes sure that the student fully understands the nature of the CNR major, and ascertains that the student's educational needs can best be met in CNR. If there is agreement that CNR is the best major for the student, the advisor recommends admission which, followed by approval of the chairperson (based on the availability of advisors and enrollment ceiling), then allows the student to select, by mutual agreement, a regular CNR advisor. If agreement is not reached, the admissions advisor might recommend another major to the student or suggest a revision of the proposal followed by another interview. Special problems that emerge in this process are handled through additional interviews with other CNR advisors and/or by seeking assistance from an Advisors' Coordinating Committee.

Students are free to select a regular advisor from among those who are available, but acceptance must be mutual. The student is assisted in this process by attempting to match the student with the most appropriate advisor in terms of subject matter expertise, interests, and experience. The selection is expedited through scheduled interviews with available advisors.

With approval, advisees are free to change advisors when appropriate to achieve the best available advising for the student's particular program of study. The request for change may be initiated by either the advisee or the advisor. The Advisors' Coordinating Committee facilitates these changes when necessary, and handles any special problems that might arise.

The most challenging aspect of advising in CNR is the assisting of advisees with appropriate lower division preparation leading to development and implementation of the "area of interest," and selection of the ten upper division core courses that constitute the formal academic work in the area of interest. The advisor encourages advisees to utilize all available resources and seek all available advice pertaining to the individual area of interest, and assists in the identification of those resources, both on- and off-campus. The advisor requires that the advisee carefully define and describe the area of interest and defend the ten courses selected for the area of interest requirement. This is done in writing and in active consultation with the advisor. Presumably, the courses selected for the area of interest constitute the most appropriate set of ten courses that are available to the student. In some cases, students are encouraged to enroll in courses offered on other campuses if it appears that this would improve the area of interest program.

Of the committees established to administer to the needs of the major, the most important was the Administrative Committee, which was established at the beginning of the major and still exists today. It was designed to oversee the major and to assist the chairman with its administration. Its membership includes representation from the more active permanent faculty participants, the student body, temporary faculty, general instructional assistants, non-academic staff, and faculty-at-large. All other committees are subordinate to this committee.

By the end of the first two and one-half years of the experimental major it was clear to the majority of faculty participants that it should be established as a regular curriculum on the campus. How this should be done and the nature of permanent resources needed to be assigned to the major, however, was not so clear. There were certain problem areas that were clearly in need of resolution in order for the major to continue to function properly and to continue to improve. The most important of these was the need of a system for faculty assignment to the major, need of an established base budget, needed increases in space and facilities, and greater visibility of the major.

The Period of Uncertainties: 1972-73 through 1973-74

This was the most critical period for the CNR major. It had operated for two and one-half years on zero base budget, inadequate space and facilities, and, most importantly, with a volunteer faculty who contributed time to teaching, advising, and committee work with no release time from their respective departments. With a growing program, by early 1972 there was clearly a pressing need to improve the level of support. How to do so created a basic uncertainty.

This was a period of uncertainties for a number of other reasons as well. During 1974 the major was to undergo a faculty review, called for at the time of its establishment as an experimental major, to determine whether it would be converted from experimental to regular status or discontinued. Additionally, throughout the entire period, planning for the merger and reorganization of the College of Agricultural Sciences and School of Forestry and Conservation into a new College of Natural Resources not only created controversy and fueled uncertainty, but also sapped energy and resources that would likely have been available to CNR.

During this period enrollment in the major continued to grow: from 213 during spring quarter 1972 to 305 students during spring quarter 1974. By June 1974, an additional 179 had graduated, bringing the total of CNR alumni to 264.

A substantial number of new courses were being offered by the end of the period. These were: IDS 10L-10M-10N, CNR 101 (now CRS 101), CNR 110 (CRS 110), CNR 180 (CRS 180), CNR 191A (CRS 40-40L), CNR 191B (CRS 115), CNR 191C (CRS 150), CNR 191D (CRS 151), CNR 191F (CRS 131), CNR 191G (CRS 132 and 133), and several other experimental courses that are no longer offered. Course enrollments also increased to nearly 1400 students in 1972-73 and to more than 1700 students in 1973-74.

Although no significant improvements were made in assignment of faculty to the CNR major and in the accountability and crediting of faculty participation, the problems that obtained from reliance on volunteers, which had grown to serious proportions by early 1972, were alleviated to a tolerable level during the next two years. This came about for several reasons. First of all, those faculty participants who started during the early days of the major were now veterans who could continue their participation with increased efficiency in the utilization of their time and, more importantly, who were convinced of the value of the major and consequently reaffirmed their commitments to it, compensation or not. Secondly, there was an increase in the number of faculty participants (the number of advisors, for example, increased from 25 to 45 during the period) such that even in an expanding program the workload per participant remained about the same or even decreased somewhat. Thirdly, even though the base budget remained at zero, increases in the level of support in terms of temporary faculty positions, course assistants, supplies and expenses, non-academic staff, and space and facilities, demonstrated increased commitment to the program by the administration. Fourthly, imminence of reorganization and formation of a new college held the promise of formal faculty assignments to CNR. Finally, there was a growing feeling that a predominantly volunteer faculty might be a serendipitous strength in the program that should be retained regardless of future developments in its formalization.

Still the problems of almost total reliance on a voluntary faculty, contributing their time with no compensatory release time and with little accountability continued to magnify the problems of administration and long-range planning of the major. For example, course staffing by volunteers continued to be done on an ad hoc basis. The process continued to come about mainly by the chairman contacting faculty members on an individual basis and requesting that they teach a course or a section of a course. This had to be done quarter by quarter since each faculty member needed frequent reassessments of the amount of time he or she could spare relative to responsibilities in their regular appointments. As a result, course assignments were usually not completed until a week or so before the start of the quarter. This problem was compounded by the growing realization that, in the absence of "official" assignment to CNR participation, little if any credit toward promotion (and for Assistant Professors, credit toward tenure) was given for that participation. Promotion appeared to be based, in most cases, solely on activities related to the faculty member's official assignments in teaching and research. The problem of suitable recognition has still not been resolved, but the degree of involvement attests to the high regard that the volunteer faculty have for the CNR major and to the exceptional conscientiousness and devotion to duty that they have.

The need for increased teaching support was provided in part by increased commitment by a larger number of volunteer faculty and in part by an increase in allocations of Teaching Associate positions and new positions for the hiring of temporary Lecturers. The allocation of temporary Lecturer positions was an especially important development since they not only provided much-needed immediate increases in teaching staff but would also provide the basis for future permanent positions through conversion of temporary to permanent F.T.E. This mix of faculty volunteers and assigned, albeit temporary, faculty, together with off-campus appointees without stipend provided the opportunity to develop an innovative format for the future staffing of the CRS Department.

The offering of an increasing number of courses resulted in another, although not unexpected, problem--the tendency for CNR majors to use those courses, even though not required, in the building of their individualized programs rather than relying mostly on campus-wide offerings. Even though the courses offered by the major, and later the department, cover a wide range of conservation and environmental topics and are generally interdisciplinary in character, the common and frequent utilization of them would tend to progressively result in uniformity of students' individual programs of study. The major would thus become more "departmentalized" which would tend to defeat the purpose for which it was established. However, by keeping required courses in the major to a minimum and, through the advisors, discouraging the use of the department's courses until possibilities outside the department have been thoroughly exhausted, the problem can be alleviated; but constant vigilance is required.

During this two-year period, there developed a strong appreciation for directed group study courses (CNR 198's)[8] in majors such as CNR. The CNR program is dedicated to providing its students with the best available educational experiences. One way in which this is expressed is through concerted efforts to cultivate and nurture the individual student's creativity and interests. However, students generally respond to such efforts only if they are convinced that their educational experiences are relevant. Degree of relevancy is usually expressed as a measure of the apparent gap between what "society"/"the world" seems to need and what "university expertise" seems to be providing.

Attempts to narrow this gap have been strongly manifested in recent years, within the context of a deteriorating environment (the so-called environmental crisis), by universities responding in the direction of increased community outreach; providing increased innovativeness, interdisciplinarity, and flexibility in their overall educational programs and course offerings; and by the creation of new programs, such as CNR, primarily under the general heading of environmental studies. However, response is quite often too slow for the usually impatient students and often impatient faculty.

In terms of courses and curricula, quick response to student and programmatic needs can be at least partially accomplished through the liberal use of directed group studies. Since 1972, students in the CNR field major have been encouraged to consider directed group study possibilities for subject matter of interest to them (especially that perceived to be important to their areas of interest) that are not available from the regular campus course offerings. As a result, requests for directed group studies have been frequent and numerous; and the major and the department have sponsored a large number of such courses covering a wide range of topics.

Most of the group studies sponsored by CNR have dealt with contemporary issues and with interactions between populations, natural resources, environment, and people using an interdisciplinary approach and a holistic perspective of ecosystems, regardless of the particular topic. For example, a study of "The Pygmy Forest Ecosystem and Ways to Preserve It" covered such aspects as how the ecosystem formed, its ecology, its uniqueness compared to other ecosystems; attitudes of people and institutions toward it and other unique systems; history of efforts to preserve the pygmy forest ecological staircase; social, political, and economic implications of preserving the system; impact of development on the system; and so on.

Furthermore, most of the group studies classes have routinely utilized off-campus resources and in many ways interacted with off-campus personnel and institutions, generally contributing to community-outreach by the University. In this same vein, interaction with students, faculty, and programs of other campus units has been encouraged and utilized where appropriate.

The importance of directed group studies to the CNR major has far exceeded the value to enrolled students. Those faculty members solicited to lead studies oftentimes become acquainted with the major, and many subsequently elect to participate in it. The studies have richly exploited valuable teaching resources, both off and on campus, such as emeritus professors. Many of the studies have provided useful ideas for programmatic improvement. Most importantly, however, they have helped maintain vitality in the major.

Another important result is that many of these studies have led to development of experimental courses; and, subsequently, some of these have led to regular course offerings in the CRS department. These, in turn, have led to identification of teaching and research areas that have generated requests for new permanent faculty positions.

The addition of two new non-academic positions, several more offices, and other increases in support during this period improved the capability to administer to the needs of the major. This additional support, in the face of uncertainties generated by the impending review of the major and by efforts toward reorganization and formulation of the new college which, by early 1974, was beginning to take shape, also increased the confidence that there was a future for the major on the campus.

The review of the major, which officially began in January 1974, provided a much-needed opportunity for the CNR faculty and students to thoroughly assess the major. By June it was clear that the review committee was going to recommend that CNR be continued as a regular major. It was equally clear that many shortcomings in the major were discovered and that the committee would be submitting a long list of recommended improvements. However, the details of these recommendations had to await the filing of the committee's report, which didn't take place until October.

In the meantime, the College of Agricultural Sciences and the School of Forestry and Conservation submitted the long-awaited proposal for merger, reorganization, and creation of the new College of Natural Resources, which was approved effective July 1, 1974. Of particular importance to the CNR major was the creation of the new Department of Conservation and Resource Studies which was to include a new major, Political Economy of Natural Resources, as well as the ongoing CNR major, pending approval of the CNR review committee.

The Early Days Within a New Department and a New College: 1974-75 through 1975-76

It was clear to the faculty who had participated in the CNR program from the beginning that the major was having a very strong and positive impact on the College and School. Evidence of this was overwhelming, and manifest in a number of ways. For example, combined undergraduate enrollment in the two units was 244 students during spring quarter 1969. Spring quarter combined enrollment following the establishment of the CNR experimental field major in January 1970 increased progressively to 379, 507, 640, 787, and 935 in 1970, 1971, 1972, 1973 and 1974, respectively. The CNR major consistently constituted approximately one-third of the total but by spring 1974, just prior to the establishment of the College of Natural Resources, combined enrollments in the other majors of the College and School were 630 students, an increase of 386 students over the 244 student enrollment of spring 1969. Thus, the new College of Natural Resources was launched with an undergraduate enrollment of approximately 1000 students--a greater than four-fold increase over a period of only five years.

The positive and influential effects of the strong interaction among faculty in the College and School via the CNR major was also clearly manifested in the reorganization. Only a cursory reading of the proposal to establish the College of Natural Resources[9] reveals this.

The new College was designed with several innovative features, included partly in response to the opportunity to create a better institution, and modified as apparent need dictated to retain large elements of the status quo. Three new departments were created to administer the undergraduate teaching programs. Previously existing departments and the school were designated departments of graduate instruction and research. Several new undergraduate majors were created, a few remained as they were, and some were modified somewhat. The most novel feature of the new college was the creation of Faculty Panels to oversee each undergraduate major. No changes were made in any of the graduate or research programs. The resulting organization of the College of Natural Resources was as follows:

Departments of Undergraduate Instruction

Department of Resource Sciences

- Biology of Natural Resources Major
  - Bioenergetics emphasis
  - Bioresource Sciences emphasis
  - Entomology emphasis
  - Genetic Resources emphasis
  - Plant Pathology emphasis
  - Soil and Plant Resources emphasis

Food, Nutrition, and Dietetics Major
  - Food Science emphasis
  - Nutrition emphasis
  - Dietetics emphasis

Preveterinary Program

Department of Forestry and Resource Management

Forestry Major
Pest Management Major
Soil Resource Management Major
Wood Science and Technology Major

Department of Conservation and Resource Studies

Conservation of Natural Resources Major
Political Economy of Natural Resources Major

Departments of Graduate Instruction and Research

Department of Agricultural and Resource Economics
Department of Cell Physiology
Department of Entomological Sciences
Department of Forestry and Conservation
Department of Genetics
Department of Nutritional Sciences
Department of Plant Pathology
Department of Soils and Plant Nutrition

Interdepartmental Group Graduate Programs

Agricultural Chemistry Group
Biophysics Group
Comparative Biochemistry Group
Food Science Group
Genetics Group
Nutrition Group
Parasitology Group
Plant Physiology Group
Range Management Group
Soil Science Group
Wildland Resource Science Group
Wood Science and Technology Group

In the proposal for the establishment of the College of Natural Resources, it was stated that further reorganization, concentrating on departments and programs of graduate instruction and research, would evolve as experience was gained with the "phase one" reorganization. It was implied that "phase two" reorganization would likely be along the lines of the purviews and structures of the three departments of undergraduate instruction. It was further implied that during the interim, budgets for undergraduate instruction and

F.T.E. assigned to the teaching of undergraduate courses would be transferred from the previous departments to the three new departments. This would have resulted, of course, in joint appointments between the departments of graduate instruction and research and departments of undergraduate instruction for all faculty members who taught undergraduate courses.

A myriad of problems, both real and imagined, arose in connection with the anticipated transfers of appropriate support budget and F.T.E.'s to the undergraduate departments. As a result, the transfers did not take place. Consequently, budgets and F.T.E. remained with what were now graduate and research departments, while the bulk of instruction took place in the undergraduate departments, sans budget and F.T.E. The undergraduate departments were thus faced, to varying degrees of adversity, with the same situation that the CNR major had faced during the previous four and one-half years (and would now continue to face to the present): operating with a zero base budget, inadequate space and facilities, and a "borrowed" faculty. This arrangement over the next three years eventually led to a different "phase two" reorganization than was anticipated at the time the College of Natural Resources was established.

The most significant event affecting CNR during this period was the release of the report from the committee that reviewed the experimental major.[10] This committee conducted an exceptionally thorough examination of the major, and its comprehensive report included extensive and cogent commentary on both the strengths and shortcomings of the major, together with a long list of recommendations. Because of the importance of these recommendations to CNR, and because they should also be useful to similar majors at other universities, they are given here.

Recommendations concerning goals of the CNR Program:

1. Descriptions of the major and admission procedures should make it clear to students that CNR provides a broad generalist's background in conservation. Incoming students should be informed through advising or admissions procedures that job opportunities for the broad CNR "generalist" exist, but that the major is not designed to prepare students for specialized resource management positions. In order to avoid misunderstanding, students and their advisors should discuss career goals as well as area of interest.

2. Though it is an undergraduate program, the CNR major should be recognized as characterized by a central commitment to a research program and the mastery of problem-solving skills and their application to the problems addressed through this major.

Recommendation concerning innovations in the CNR Program:

3. Equal numbers of students and faculty should be elected to the Committee in Charge of the CNR Panel. Students will be elected by the CNR student body. These same students will act as student representatives on the Panel. Student participation will be subject to the following Academic Senate regulations: (1) when the Panel makes recommendations to any body to which authority has been delegated by the Berkeley Division of the Academic Senate, the student members are full voting members; (2) when the Panel represents authority delegated by the Division, the students shall not vote; and (3) when the Panel makes recommendations to those who have been delegated authority by the Chancellor, the student vote is to be recorded separately. Student membership on other CNR committees should be subject to the same regulations.

Recommendations concerning course requirements:

4. Procedures should be designed which require every declared CNR major to evaluate his or her objectives and progress at the beginning of every quarter with the advisor, as a part of the advising process. Annual peer evaluation and interaction should be required in the form of at least one course or seminar each year in which the student presents original ideas or a project to fellow CNR students. The existing CNR 49 and 149 courses serve the latter purpose for entering students and seniors. Continuity in peer evaluation needs to be developed by initiating an intermediate course.

5. General interest, interdisciplinary courses sponsored by CNR should be reviewed annually by faculty with expertise or interest in the topics covered by the course. The course reading list and lecture schedule should be circulated to interested faculty for comment.

6. Both the flexibility and the interdisciplinary of the CNR program should be preserved. To accomplish these goals, core requirements should be kept to a minimum, and both the number of units of CNR courses a student may take and the number of courses listed under the CNR heading should be limited.

Recommendations regarding voluntary participation by regular staff:

7. The interdisciplinary character of the CNR major should be strengthened by recruiting more faculty instructors (and advisors) from outside the biological sciences.

8. The Dean of the College should insure that adequate recognition of a faculty member's participation in the CNR program is provided to promotion and merit review committees.

9. The CNR program should adopt an accounting system that documents the nature and extent of faculty participation in the major.

Recommendations regarding appointment of temporary staff to the CNR Program:

10. Selection and appointment or reappointment of Associates (and Teaching Assistants and temporary Lecturers) for a given academic year should be conducted during the preceding spring quarter to permit advanced course and program planning. In addition, they should be appointed for one-year periods, subject to review after the first quarter of service. Associates (and Teaching Assistants) seeking reappointment are to be considered on an equal basis with new applicants. No Associate (or Teaching Assistant or temporary Lecturer) should hold an appointment for more than a total of three years.

11. The trend toward greater delegation of responsibility for course development and teaching to temporary Lecturers and Associates should be carefully examined and supervised by the chairman of the Department to which the CNR program is assigned.

Recommendation concerning team teaching of courses:

12. Whenever the instructional staff of a CNR course includes more than one member there shall be regular consultation among them during the planning, execution, and evaluation phases of the program for that course. This is to be considered a duty to be performed irrespective of who has the major responsibility for that course.

Recommendations concerning CNR administration:

13. Student participation in the administration of the CNR program and in the design of courses should be continued.

14. The CNR administrative officer should call for and transmit to the Dean early in the spring quarter an annual self-evaluation and review report prepared by a CNR Program Review Committee with whatever recommendations for change the following year that may be appropriate.

Recommendation concerning CNR budgetary support:

15. The CNR program support budget should be regularized; and this funding should initially be acquired from sources outside the College jurisdiction, thereafter to be maintained within the regular new College budget.

Recommendation concerning student enrollments in CNR:

16. Action should be taken to enlist a greater proportion of freshmen and sophomores in the CNR major and although enrollment of advanced undergraduate transfers should not be prohibited, it should be restricted. Admission priorities should be set so qualified freshmen/sophomores are accepted before junior/senior transfers of equal qualification. In all cases students should be required to take a minimum of five quarters in the CNR major.

17. In the spring the administrative head of the CNR program, with the advice of the program's members, ought to recommend to the College of Natural Resources the proposed number of majors to be established as the limits for the next year's activity of the program. This number will establish the lid for new declarations of major by subtracting from the total those that are continuing within the program. The number to be recommended to the College is to be defined as the lesser of two figures: (1) the number of students particular members of the faculty are willing to accept for the following two-year period as advisees (not to exceed 15); or (2) the number of students that can be accommodated in all sections and seminars required in the given year, where enrollment in each section and seminar is limited to 15 students.

Recommendation regarding use of grades to measure student performance:

18. The usefulness and meaningfulness of letter grades as indicators of scholarly accomplishment and promise in the CNR major should be evaluated, redefined where necessary, and guidelines established to insure that grading is consistent with the objectives of the major. A committee for this purpose should be appointed by the administrative head of the program and should include representatives from the more discipline-oriented programs of the College.

Recommendations concerning the CNR advisory system:

19. The present system of advising where the student chooses an advisor and initiates the consultation with him should be continued. The advisor should have the right to terminate such advisor-advisee associations after due notification.

20. Advisors for the CNR program should include faculty located in departments outside the College of Natural Resources.

21. The CNR Advisors' Handbook should describe briefly other majors concerned with environment on campus which might be of interest to the CNR student.

22. Advisors should be required to meet certain conditions for appointment, including attendance at a briefing session, their agreement to serve for a specified period of time, an agreement as to the maximum load they will accept each year, and an agreement to meet with colleague advisors at least twice annually to consider and resolve problems of students pursuing the major.

23. Additional College faculty should be recruited into the ranks of program advisors through an annual invitation and meeting to discuss the progress of the major and the details of the advisory system.

24. Each quarter a two-day advisory period should be declared and announced to all students and instructors in the program. Not later than one month in advance of the specified period, any advisor who cannot be present in his office at that time shall so notify his advisees and arrange for alternative times for consultation.

25. Students in their senior year in the major should be invited to participate in advising new students in the program.

26. The advisory services of a faculty member shall be recognized by formal notice of such service from the administrative head of the CNR program to the faculty member's "home" chairperson.

Recommendation concerning student facilities:

27. A common student-faculty work space for purposes of conferences, meetings, advisory activities, and an associated lounge should be provided to facilitate program interaction and community interest.

The report of the review committee was accepted by the College faculty during fall quarter 1974 and CNR was approved as a regular major retroactively to July 1, 1974. Many of the recommendations of the review committee have been resolved; some have yet to be resolved, although efforts to do so are still underway.

By the close of the 1975-76 academic year the department was offering 49 courses under four different designators. All previous CNR courses except for CNR 49, 149, 197, 198 and 199 were given CRS designators and offered as departmental rather than major courses, as was the intent when they were first developed. Five courses previously in the Department of Agricultural Economics were transferred to CRS: CRS 23, 160, 161, and 170A-170B. New courses developed during the two-year period were CNR 99 and 109; CRS 118, 130, 163, 191E, 191F, and 191G; and PENR 1, 100A-100B-100C, 195A-195B-195C, 197, 198 and 199.

The CNR and PENR courses were offered primarily for students in those majors. The CRS and IDS courses were designed to serve multi-purposes: (1) for CNR and PENR students, covering subject matter important to significant numbers of students in the two majors, and generally unavailable from other campus courses; (2) as restricted electives for students enrolled in other majors, particularly in the College of Natural Resources; and (3) as general interest courses for students throughout the campus who might want to explore the possibility of transferring into one of the two majors, or who simply might want to sample the character of the department. The difference between CRS and IDS courses is that the latter are co-sponsored by more than one department or have a significant percentage of faculty participants from more than one department.

The new PENR major was designed with a purview similar to that of the CNR major, but with an emphasis in the social sciences and with less flexibility and more specific course requirements. Thus, students enrolled in this major[1] explore those aspects of human behavior, economic systems, and social institutions which affect and are affected by the management of natural resources and the environment. The framework of study combines the perspectives of economics, sociology, political science, and law. The curriculum includes disciplinary approaches to natural resources and courses specifically designed to integrate the different social science approaches to the dilemmas associated with resource-based social needs. The major requirements are structured to provide opportunity for specialization in one discipline or one area of resource management. There were 48 students in this major in spring quarter 1975 and 95 students by spring quarter 1976.

Enrollments in the CNR major also continued to climb--to 388 students in spring quarter 1975, and to a peak of 453 students by spring 1976. A total of 260 students graduated from the major during the two years bringing the total of CNR alumni to 524 by June 1976.

Course enrollments also climbed dramatically, to more than 2500 during 1974-75 and to nearly 3000 during 1975-76. This was due not only to the greater number of courses but also to increasing enrollments in many of them, attesting to the greater visibility and increasing popularity of the department's courses and majors.

The decision not to transfer budgets and F.T.E.'s to the departments of undergraduate instruction was a great disappointment to those faculty who had labored long and hard as "volunteers" in the CNR major. Thus, during the first two years of the CRS department nothing had changed with regard to faculty participation over that previously in the CNR major. The same was true of general support, space and facilities, and non-academic staff. Even though there was substantial growth, no significant increases were obtained during the two-year period. However, in 1975-76 the department was for the first time given a small base support budget and, more importantly, authorization to recruit for its first permanent faculty position.

The creation of the new department, approval of the CNR major as a regular curriculum, allocation of a base support budget (even though much too small), and the authorization to recruit for the department's first permanent faculty position were significant events to the CNR program during this period. Another significant event was the favorable reception by the administration of the department's first five-year Programmatic Development and Faculty Budget and Recruitment Plan, 1976-77 through 1980-81. The authorization for recruitment for the permanent faculty position was the first step toward implementation of that plan.

The inclusion of the PENR major in the CRS department, along with the strongly interdisciplinary CNR major, added new aspects to the interdisciplinary nature of the department. Thus, the department's collective faculty, i.e., those teaching CNR, CRS, IDS, and PENR courses, advising CNR and PENR students and/or participating as members of the CNR and PENR Faculty Panels, began to give more serious consideration to humanistic, social and behavior aspects, as well as physical, biological and economic aspects of problems associated with conservation and other environmental issues pertaining to renewable natural resources. The CNR and PENR undergraduate majors together gave the department a very broad interdisciplinary base.

Moreover, the inclusion of PENR gave added impetus to increased impact by social scientists to both the CNR major and the department. As the CNR review committee pointed out, the faculty participants in the CNR major, and subsequently the CRS department, were dominantly biological and physical scientists, and both this major and the department were designed to broadly integrate the natural and social sciences in dealing with environmental and renewable natural resources issues. The committee thus recommended the recruitment of faculty members from outside the biological sciences to correct staff purview imbalance. Therefore, the inclusion of the PENR major helped immediately to correct this imbalance. The department's programmatic and faculty recruitment plans have been developed to further improve balance by giving priority to recruitment of social scientists and humanists.

The Period of Institutionalization: 1976-77 through the Present

This period has been marked by a "settling down" of the CRS department and its two majors; by stabilization in student enrollments in the two majors; by substantial increases in support and in space and facilities; by faculty recruitment; by planning toward graduate and research programs in the department; and by "phase two" reorganization of the College of Natural Resources which resulted in reaffirmation of support for the CRS department and faculty approval for the department to develop and offer programs of graduate instruction and research in addition to undergraduate instruction.

Due to enrollment ceilings, the number of CNR majors dropped to 348 students by spring 1977 with a projection of 325 students by spring 1978. The PENR major had 113 students in 1977 and about the same number is projected for 1978. Another 152 students graduated from CNR during 1976-77 and another 155 graduates are projected for 1977-78. This would bring the total CNR alumni to 831 at the end of June 1978.

Three new courses, CRS 140, 191A and 191B, were developed during this period and IDS (Physics) 80 became a joint offering by CRS and the Department of Physics. Course enrollments continued to climb to a total of nearly 3200 students during 1976-77, with a projection of about 3500 students for the 1977-78 academic year.

Substantial increases in support were given to the department during this period, although an exceptionally small base budget still somewhat hampered long-range planning. Increases were most noteworthy in general instructional assistant provisions and in non-academic staff. For the first time, the department was given Teaching Assistant positions, along with Associate and Reader positions it previously had. Also for the first time, instructional assistance closely matched need. Although there were substantial increases in support of non-academic staff, it was in temporary support. Consequently, only casual employees could be hired. On the brighter side, the department's two permanent non-academic staff positions were upgraded to Administrative Assistant positions.

Space assignment to the department was more than doubled, to six offices. This still left the department considerably short of needs, but the College is still in the difficult process of locating additional space. Facilities were also increased. The most noteworthy was the establishment of a departmental Resource Center/Library.

A second permanent position was authorized for recruitment just prior to 1976-77, followed by authorization for two more during 1976-77. These positions were requested and authorized according to a recruitment plan, initiated in July 1975, for the gradual recruitment of permanent faculty appointees to fill needed programmatic gaps and generally to augment and strengthen input from volunteer and temporary faculty. This plan was subsequently expanded during 1976-77 to include the development of joint appointments for members of the "volunteer" faculty who requested them; to secure appointments without stipend for appropriate and qualified off-campus professionals; and to retain several temporary Lecturer positions. These together with a continuation of voluntary faculty input, albeit with adequate accountability and recognition, would give the department both the stability and flexibility needed for progressive improvement and, through its courses and programs, to continue to: (1) emphasize interdisciplinary aspects of environmental issues and utilization of renewable natural resources; (2) concentrate on areas of interaction among natural resources, populations, technology, societal institutions and cultural values; (3)

actively foster linkages and interaction between the department and other campus units and off-campus institutions; and (4) serve as an interactive bridge between the professional and the science programs of the College of Natural Resources.

Three of the four new permanent faculty positions currently are joint positions. The first, Assistant Professor of Resource Policy and Environmental Law, Planning and Administration, is a joint position with the Department of Agricultural and Resource Economics; the second, Associate Professor of Conservation and Resource Studies, is a joint position with the Department of Forestry and Resource Management; and the third, Assistant Professor of Environmental Philosophy, Ethics and History, is a joint position with the Department of Entomological Sciences, Division of Biological Control. The first two positions have been filled, with both appointees due to join the department by July 1, 1978. Recruitment is well underway for the third position and it should be filled before the beginning of the 1978-79 academic year. Final details of the fourth position, Assistant Professor of Environmental Assessment and Planning, have not been completed. However, it is anticipated that it will be filled by late 1978.

In addition to these, the department has requested five more new positions to be filled over the period of 1979-80 through 1982-83. Tentatively, these would cover the teaching and research areas of: (1) Environmental Science; (2) Environmental and Conservation Policy; (3) Environmental Education and Communication; (4) Ecological Land-Use Planning and Policy; and (5) Conservation of Land Resources.

There are currently about 50 members of the Berkeley permanent faculty mostly from the College of Natural Resources, who are either teaching courses or advising students, or both, in the department. In every respect, except in official appointment and assignment of F.T.E., they function, together with temporary faculty appointees and Lecturers without stipend, as the CRS department faculty. Many of them have indicated a desire for a joint appointment with CRS, and a few have already initiated a formal request. The department is currently negotiating for these joint appointments, and anticipates that over the next several years most, if not all of them, will be obtained.

Students have played a very important and effective role in the development and administration of the major. They have been highly active throughout the history of the major, especially during the first several years and recently, and the department has been able to progressively increase support of their activities. Recently, the students began concerted and organized efforts to increase the effectiveness of their activities and to strengthen their community. They have been sponsoring frequent social events and career seminars; publishing an improved and more frequent newsletter, The CNR Review; developing a student handbook and assisting with revision of an improved advisors' handbook; assisting with the development of a more functional center for internship, career, and graduate and professional school opportunities; and assisting with the development of a CNR alumni organization. These are some of the more noteworthy activities, in addition to those associated with general administration of the major, that have emerged from a revitalized student body.

In October 1976 the department submitted to the Graduate Council of the Berkeley Graduate Division a proposal for a program of graduate studies in Conservation and Resource Studies for the Master of Science Degree, and the establishment of a Graduate Faculty in Conservation and Resource Studies.[5] The proposal is currently in the process of revision, but pending approval the department should be ready to offer the program by the 1979-80 academic year. The CNR major essentially served as the academic model for the proposed graduate program, just as it did for the CRS department.

The proposal requests the establishment of an interdisciplinary program, entitled Conservation and Resource Studies, as a graduate sequel to the CNR and PENR undergraduate majors. The program is designed for students who have earned their Bachelor's degrees in "conservation"-related or "environment"-related areas or in any major or course of study dealing with aspects of natural resources, and would be characterized both in research and in program by its focus on interdisciplinary problem-solving, particularly in the area of renewable natural resources.

Approval of the proposal is considered to be vital not only in terms of need for the program *per se*, but also in terms of providing strength and better direction in the CNR and PENR undergraduate majors. Moreover, the program would encourage interdisciplinary research and teaching among the graduate faculty, themselves and with others, which also would strengthen the department. The graduate faculty for the proposed program would be very broadly based in terms of the number of departments and disciplines represented. In addition to those who have already agreed to serve with the group, faculty membership will be open to any interested members of the Berkeley faculty who are considered appropriate to the purview of the graduate program.

The proposal for a research mission and program has not been completed. However, in the development of the graduate program proposal, the committee necessarily discussed and developed ideas of what a research program in the department would be like. A CRS research program would be interdisciplinary in nature and would generally fit the character of the CNR and PENR undergraduate majors and especially that of the CRS graduate program. Thus, the department would foster and encourage interdisciplinary team research that would be integrative with its academic programs and deal with problems associated with conservation and other environmental issues relating to renewable natural resources.

Interdisciplinary team research on renewable natural resources problems, by faculty participating in the academic programs of the department, not only would strengthen those programs but would also allow the holistic treatment of those problems with regard to the complexities that are inherent in many, if not most, of them. Furthermore, with the broadly interdisciplinary CRS department administering the research program, many of the administrative problems encountered by interdisciplinary research teams of the past, which limited their effectiveness and often led to unnecessary frustrations, would be more easily avoided. This, together with the integration of research and academic programs, and the training of graduate students, would give the CRS department a powerful potential for effective solution of complex environmental problems that have heretofore been insoluble, or for which purported solutions have ultimately resulted in a worsening of the problem.

Although there are strong mutual benefits of volunteer faculty contributors to interdisciplinary programs such as the CNR major, in the absence of adequate recognition and credit being given to the contributors there can also be serious problems and disadvantages. For four and one-half years the CNR major relied on a volunteer faculty with, generally, the absence of recognition and credit to the contributors. With the establishment of the College of Natural Resources it was believed that this situation would have been rectified, but the decision not to transfer budgets and F.T.E. to the undergraduate departments made the situation worse rather than better.

In an effort to rectify this situation, the faculty of the College of Natural Resources, in January 1977 requested that the administration develop a system of accountability and control of faculty teaching activity, whereby faculty appointments could remain entirely in the graduate teaching and research departments. A college-wide procedure for the assignment of teaching responsibilities was called for, with an ex post facto accounting of courses actually taught with each staff member suitably recognized and rewarded for his or her total involvement in undergraduate and graduate teaching, student advising, and research. This procedure, however, was not implemented. If it had been, it probably would have alleviated most of the accountability problems associated with teaching in the undergraduate programs, with the added benefits of better articulation and understanding between the departments and in a more cohesive college community.

Due in part to the failure to implement this accountability procedure as an alternative to joint appointments, faculty confidence in the organization of the College of Natural Resources began to erode more rapidly. Moreover, there was a growing sense of urgency to get on with "phase two" of the reorganization. As a result, in a rapid series of events a different kind of "phase two" reorganization plan, from the one that was envisioned when the College was established in 1974, was presented to the faculty in May 1977. In essence, the proposal called for a retention of Faculty Panels to oversee undergraduate majors and a merging of undergraduate teaching programs with graduate teaching and research programs. However, the merging would generally be in the direction of the graduate departments rather than in the direction of the undergraduate departments.

Thus, at its June 1977 meeting, the faculty approved the dissolution of the Department of Resource Sciences and the transfer of its undergraduate courses and majors to the appropriate departments of graduate instruction and research. The fields of emphasis under the Biology of Natural Resources major were to be installed as separate majors. Further, they approved the merger of the Department of Forestry and Resource Management and the Department of Forestry and Conservation into a single Department of Forestry and Resource Management, and a transfer out of that department of the Soil Resource Management major and the Pest Management major. Finally, they approved a resolution that the Department of Conservation and Resource Studies should be given full departmental status with authorization to conduct undergraduate courses, graduate courses, and research. The CNR major would be retained by this department, but the PENR major would be jointly administered by this department and the Department of Agricultural and Resource Economics. Thus, the undergraduate departments ceased to be, as each department retained in the College was given full department status.

The resulting "phase two" reorganization of the College of Natural Resources is as follows:

Departments of Undergraduate and Graduate Instruction and Research

- Department of Agricultural and Resource Economics (ARE)
  - Agricultural and Resource Economics Graduate Program

- Department of Cell Physiology (CP)
  - Bioenergetics Undergraduate Major

- Department of Conservation and Resource Studies (CRS)
  - Conservation of Natural Resources Undergraduate Major

- Department of Entomological Sciences (ES)
  - Entomology Undergraduate Major

- Department of Forestry and Resource Management (FRM)
  - Forestry Undergraduate Major
  - Wood Science and Technology Undergraduate Major
  - Forestry Graduate Major

- Department of Genetics (G)
  - Genetic Resources Undergraduate Major

- Department of Nutritional Sciences (NS)
  - Food, Nutrition and Dietetics Undergraduate Major
    - Food Science emphasis
    - Nutrition emphasis
    - Dietetics emphasis

Department of Plant Pathology (PP)
  Plant Pathology Undergraduate Major
  Plant Pathology Graduate Program

Department of Soils and Plant Nutrition (SPN)
  Soil and Plant Resources Undergraduate Major
  Soil Resource Management Undergraduate Major

Interdepartmental Undergraduate Majors

- Animal Resource Sciences Undergraduate Major
- Bioresource Sciences Undergraduate Major
- Pest Management Undergraduate Major (ES and PP)
- Political Economy of Natural Resources Undergraduate Major (ARE and CRS)

Interdepartmental Group Graduate Programs

- Agricultural Chemistry Graduate Group (mainly NS)
- Biophysics Graduate Group (mainly CP)
- Comparative Biochemistry Graduate Group (mainly NS)
- Food Science Graduate Group (mainly NS)
- Genetics Graduate Group (mainly G)
- Nutrition Graduate Group (mainly NS)
- Parasitology Graduate Group (mainly ES)
- Plant Physiology Graduate Group (mainly FRM, PP and SPN)
- Range Management Graduate Group (FRM)
- Soil Science Graduate Group (mainly SPN)
- Wildland Resource Science Graduate Group (mainly FRM)
- Wood Science and Technology Graduate Group (mainly FRM)

With regard to the welfare of the CRS department, a follow-up resolution was approved by the faculty in November 1977. The resolution read, "The Department of Conservation and Resource Studies does not now have an adequate number of ladder-rank faculty F.T.E. to perform its assigned functions. It has already received authorization to jointly recruit to several open positions. A survey should be made to identify current ladder-rank faculty members of other departments of the College who are voluntarily willing to have—and interested in having—a portion or all of the F.T.E. transferred to the Department of Conservation and Resource Studies. Once identified and with proper concern for current teaching and research functions, administrative steps should be taken to transfer an appropriate number of ladder-rank faculty F.T.E. to this department."

Although it will take time to implement the full departmental status of the CRS department, the developments during the past one and one-half years should be viewed as a tribute to the efforts of those students and faculty members who, over the past eight years, have made significant voluntary contributions to the CNR major. It is to them that the CNR major and CRS department owe their existence and success.

While the CRS department's programs deal with conservation and environmental issues within an ecosystem framework, i.e., a whole-systems approach, this cannot be successfully done without sound knowledge of the parts of the system. Furthermore, interdisciplinary problem-solving methodologies are, by necessity, formulated from time-tested methodologies of the various contributing disciplines. Thus, interdisciplinary programs that are strongly supported by the underlying disciplines and professions are more apt to be successful than those that are not. Fortunately for the CNR major and CRS department, the Berkeley faculties generally excel in both disciplinary and interdisciplinary programs.

The collective eminence of the many faculty, and the many disciplines represented, who have contributed and are contributing to the undergraduate programs in the CRS department imparts considerable departmental strength, which is expected to increase even more with implementation of the proposed graduate program. The effectiveness of faculty participation in the department, however, especially in the CNR major, derives more from the quality and dedication of faculty participants than from the absolute numbers of faculty involved. Opportunism was never a motivating force to faculty participation; but rather faculty with sincere concern for the earth and for humanity, in response to "environmental crises" or "ecology movement," were willing to add voluntary participation in their normal duties.

Even though new permanent faculty members are being recruited and faculty members from other departments are beginning to take on regular assignments in the department, faculty volunteers from throughout the campus will hopefully continue to make significant contributions. This is necessary in order to insure that the interdisciplinary integrity of the department's programs is maintained.

The institutionalization of the CNR major and CRS department, through increasing support, the assignment of permanent faculty F.T.E., and with graduate instruction and research in addition to undergraduate instruction, could easily lead to the department's slipping into the rigid, self-centered, stereotyped mold that has come to be characteristic of departments on university campuses. Continual vigilence and concerted effort will be required to prevent this from happening. Up to now it has been easy to maintain the "openness" of the major and department; for with an inadequate and unreliable budget, inadequate space and facilities, and a total reliance on a volunteer and temporary faculty, there has been little choice to do otherwise.

This then will be the greatest challenge in the future: to develop structure and procedure that will maintain, and even improve, the integrity of the CRS department and its programs.

Acknowledgments

The many contributions of students, faculty, and staff to the CNR major and the CRS department over the past eight years are gratefully acknowledged. In a sense all who participated have collaborated in writing this paper, although the author takes sole responsibility for any errors. Many will recognize in the paper ideas or innovations for which they have been responsible. The author especially wishes to acknowledge drawing liberally upon the writings of Professors Cobb, Dahlsten, Hancock, LeVeen, Libby, Norgaard, Parmeter and Schultz, and Drs. Cole and Petulla in the compilation of this paper.

NOTES

1. Much of this description is taken from the Bulletin of the College of Natural Resources 1977/78, University of California, Berkeley, Volume 71, Number 2, April 1977. 62 pp.

2. The department cosponsors, with the Department of Agricultural and Resource Economics, another undergraduate major, Political Economy of Natural Resources (PENR), which is less flexible (more structured) than the CNR major.

3. If these requirements are not completed during the freshman and sophomore years, they may be fulfilled by appropriate upper- or lower-division courses taken during the junior and senior years.

4. Courses are unspecified and are selected, in close consultation with and approval of the student's faculty advisor, from the course offerings of the entire campus, to suit the educational needs of the student on an individual basis.

5. Much of this section was taken from "A Proposal for a Program of Graduate Studies in Conservation and Resource Studies for the Master of Science Degree and the Establishment of a Graduate Group in Conservation and Resource Studies," University of California, Berkeley, October 1976.

6. Committee on Natural Resources, U.C. Berkeley. 1963. Proposal to Establish on the Berkeley Campus an Institute of Natural Resources.

7. Commentary on advising in the CNR major was taken mainly from "A Report on the CNR Major," U.C. Berkeley, September 1973.

8. Commentary on directed group studies courses taken mainly from "A Report on the CNR Major," U.C. Berkeley, September 1973.

9. Proposal for the Merger of the College of Agricultural Sciences and School of Forestry and Conservation and the Establishment of the College of Natural Resources, U.C. Berkeley, May 1974.

10. A Faculty Review of the Experimental Field Major in Conservation of Natural Resources. U.C. Berkeley, October 1974.

ENVIRONMENTAL BIOLOGY PROGRAMS AT THE UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN

by Lowell L. Getz*

Here is a beautiful example of the way a large public landgrant research university adapts, changes, grows in response to its changing environment. Almost 100 years ago, ecology in the classic sense was represented at the University of Illinois at Urbana-Champaign by the pioneering studies of professors of botany and zoology. Then there emerged ecological emphases in departments of entomology, forestry, and landscape architecture. Even more recently an Institute of Environment Studies appeared to coordinate multi-disciplinary teaching, research, and public service dealing with physical, biological, and social environmental problems. This case study focuses on the role of an even newer Department of Ecology, Ethology, and Evolution in the U.I. College of Liberal Arts and Sciences, a department rooted in the past, serving the present, helping to form the future in the broad basic field of environmental biology through B.S., M.S., and Ph.D. work.

The University of Illinois has long been recognized as a center for basic ecological training and research in North America. The University initiated training in ecology within a few years of its establishment, as a result of the impetus of the first head of the Department of Zoology, Stephen A. Forbes (1885-1921). Dr. Forbes pioneered much of the early work in fresh water ecology, including publication of one of the classic papers in ecology in 1887, "The Lake as a Microcosm." Ecology at the University of Illinois rapidly achieved an international reputation and has maintained an eminent position in this field primarily through achievements of Drs. C. C. Adams (1908-1914), H. A. Gleason (1900-1904), H. L. Shantz (1926-1928), W. B. McDougall (1914-1929), V. E. Shelford (1914-1947), A. G. Vestal (1929-1957), and S. C. Kendeigh (1936-1973).

Until the mid-1960s strength of the ecology program at the University of Illinois was based on the influence of one or two prominent staff members. During the past decade, however, the multidisciplinary requirements of ecological investigations led to the establishment of a faculty with diverse interests in the area of environmental biology. This diversity of approaches, combined with complementary

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overlap of faculty interests in related areas, provides both undergraduate and graduate students an opportunity to pursue a wide variety of specific career interests.

Environmental education at the University of Illinois, Urbana-Champaign, currently includes two major degree-granting programs, as well as four departments which grant degrees in specific areas of ecology or environmental biology. In addition, an Institute of Environmental Studies serves as coordinator of multidisciplinary research, education and public service dealing with physical, biological and social environmental problems. The Institute also offers special courses which emphasize application of basic ecological concepts to applied environmental problems. These courses introduce students to effective approaches for understanding and solving problems relating to aquatic and air pollution and environmental toxicology. Other courses involve epidemiology, environmental quality management and quantitative and systems ecology. The Institute of Environmental Studies also coordinates a Ph.D. program in Environmental Toxicology. Faculty from seven schools and colleges within the University and from the Illinois Natural History Survey participate in these research and teaching activities. Doctoral candidates receive their degrees from one of the participating academic units.

The School of Life Sciences Ecology Program constitutes the major interdepartmental doctoral program in environmental biology at the University of Illinois. This program emphasizes the study of basic interrelationships between organisms and their environment. Areas of academic specialization include physiological, population, community, systems, and evolutionary ecology. Scientists from the Departments of Ecology, Ethology and Evolution, Entomology, Botany, Forestry, Civil Engineering (Environmental Engineering Program), Genetics and Development, Physiology and Biophysics, Landscape Architecture, and the Illinois Natural History Survey participate in delivery of courses and guidance of graduate students. All students, regardless of their areas of specialization, complete a core curriculum of basic ecology courses. This includes plant ecology, population and community ecology, ecological genetics, evolutionary ecology, ecological modeling, computer science, and statistics. A wide variety of elective courses are also available to provide training in specialized areas. Such courses include aquatic ecology, bioclimatology, comparative and adaptive physiology, ecology and evolution of social structure, ethology, environmental plant physiology, evolution of adaptive systems, evolutionary theory, field ecology, field entomology, fish and wildlife ecology, evolutionary biology, limnology, natural history of vertebrates, origin of variation in plants, population genetics, plant geography, and tropical ecology. An oral preliminary examination conducted by faculty from the basic environmental sciences, ensures that each student in the program has a firm understanding of the major conceptual areas of ecology and is familiar with their application to his or her field of specialty. Students conduct their doctoral research in any of the participating departments, with their specific research adjusted to individual interests. Doctoral theses can address either basic or applied problems.

The recently established Department of Ecology, Ethology and Evolution has primary responsibility for delivery of academic courses in the area of ecology (although several specific areas are covered in other departments; see below). Major areas of academic offerings provided by the department include population and community ecology, behavioral ecology, biogeography, evolutionary ecology, and quantitative analysis of ecological systems. Both terrestrial and aquatic systems are covered in individual courses. Courses are also offered in life history, ecology and systematics of invertebrates, fish, amphibians and reptiles, birds, and mammals. Many courses provide training and experience in conducting research, as well as presentation of results and conclusions. Experience in field observations and sampling is gained through field trips associated with most courses, as well as special field trip courses. Trips are taken throughout the midwest as well as to southeastern and southwestern United States and to the tropics. The academic program places major emphasis on evolutionary interpretations as well as functional aspects of population phenomena.

The Department of Ecology, Ethology and Evolution offers Bachelor of Science, M.S. and Ph.D. degrees in the area of ecology. The Bachelor of Science degree consists of an Ecology-Ethology option under a biology curriculum offered within the School of Life Sciences. The general science requirements for the B.S. degree include one-year sequences of inorganic chemistry and physics, a laboratory course in organic chemistry, and an introduction to calculus. The biology requirements include basic courses in ecology, ethology, genetics, and evolution. The remainder of the academic requirements are tailored to the specific interests of the student.

A series of recommended curricula within the Ecology-Ethology option are available to assist students in planning their academic programs. The following career areas have been identified: animal caretaker (zoo curator), wildlife biology, aquatic biology (with specialties in either basic or applied areas), environmental sciences (environmental consulting), pest management, and naturalist. Each of these specialized curricula recommend additional biology courses applicable to the area, as well as appropriate non-biology courses. The latter include courses in the areas of agriculture, business administration and personnel management, business and administrative communication, civil engineering, landscape architecture, urban planning, political science (environmental law), and journalism, among others. The primary purpose of these curricula is not to train applied ecologists, per se; the aim is to provide strength in basic ecology which students can relate to applied situations. In all instances the recommended curricula permit the students to gain strength in the fundamental areas of biology, as well as an understanding of the applied problems in their area of specialty. Recommended curricula as preparation for graduate work in ecology or ethology are also available.

Promising undergraduate students are encouraged to begin research in the area of their specialty well before graduation. This usually consists of an initial semester of collaboration with a staff member in an ongoing research program to obtain the necessary research skills. Thereafter, the student can develop an independent research project or participate in a team research program with other students or with a faculty member. Results of the student research projects may be submitted to the department as partial fulfillment of the requirements for graduation with distinction.

The Department of Ecology, Ethology and Evolution administers a graduate degree program in the following areas of specialization: ethology, population and community ecology, biogeography and systematics and evolutionary ecology, quantitative analysis of ecological and behavioral systems. Specific academic requirements for the master's and Ph.D. degree are flexible; primary emphasis is placed on tailoring the academic program to fit the specific needs of each student.

An oral qualifying examination is given to master's candidates to ensure an understanding of basic biological principles, especially those relating to the area of ecology, ethology and evolution. This exam is also used as guidance for admission of graduate students and to the formal Ph.D. program. The doctoral preliminary exam (normally oral, but may be in part written) evaluates the student's research proposal and overall research ability, as well as his or her ability to integrate information in ecological, ethological and evolutionary literature. These two exams are used to assure high quality performance of graduate students rather than depending on a series of specific course requirements. Each student's doctoral committee recommends specific course requirements. Research for the doctoral dissertation is conducted under the guidance of a faculty member within the Department of Ecology, Ethology and Evolution. In general, dissertation research of students in the departmental program consists of studies of basic ecological phenomena.

Graduate research reflects research programs of the staff. Research interests of members of the Department of Ecology, Ethology and Evolution include: dynamics of natural populations, diversity and information of communities, behavioral ecology, including physiological behavior and mammalian reproduction, social structure in wild populations, vertebrate ethology and population biology, and animal communication; management of natural systems; bioclimatology and atmospheric ecology; aquatic ecology, including evolution of life history tactics, species interactions, and effects of stress on aquatic systems; wildlife biology; plant-animal interactions, including herbivory, pollination, dispersal; reproductive strategies and resource allocation in plants; evolution of complex adaptive systems; and biometric methods of assessing population distribution. Research work is conducted in a variety of regions ranging from arctic tundra to tropical forests, as well as in the vicinity of Urbana-Champaign. Taxonomic groups studied include vertebrates (particularly birds, mammals and fish), insects, mollusks, crustacea (including zooplankton), and flowering plants.

In addition to the ecological program in the Department of Ecology, Ethology and Evolution, M.S. and Ph.D. programs with a specialization in the area of ecology are available in the Departments of Botany and Entomology. The Department of Forestry (College of Agriculture) offers ecological training at the B.S. and M.S. level while the Department of Landscape Architecture provides training in environmental biology at the masters level. Research interests of faculty and available courses in these departments are as follows:

Botany —Physiological ecology; responses of populations and communities to environmental stress, plant demography; role of microorganisms in decomposition of plant material in streams, trophic structure of streams. Course offerings include Plant Ecology, Aquatic Plant Ecology, Environmental Plant Physiology, and Plant Geography.

Entomology —Behavioral and physiological ecology of insects as they apply to plant-insect interactions and mimicry; community ecology of insects; parasitoid-host, herbivore-plant and pollinator-flower interactions; environmental toxicology. Course offerings include Insect Ecology, Insect Control, Agricultural Entomology, and Chemistry and Toxicology of Insecticides.

Forestry —Nutrient cycling in forest ecosystems, soil-site relationships, microenvironmental analyses, forest sucession, effects of forest management on water quality. Course offerings include Forest Ecology, Environment and Plant Ecosystems, Forest Soils, Forest Tree Diseases and Silviculture.

Landscape Architecture —Systems ecology, environmental impact analysis, land use planning, and resource management. Course offerings include Environmental Impact Assessment, Environmental Change and Public Policy, and Land Use Ecology.

Research facilities at the University of Illinois include four natural areas located near the campus. These include three major terrestrial habitat types - upland deciduous forest, bottom land forest, and reconstituted prairie. Streams, rivers and ponds also occur within the natural areas. Another 130-acre tract of land located ten minutes from campus is available for manipulative studies. The University of Illinois library, with holdings of over 5 million volumes, is the fourth largest university library in the world; holdings in biology are exceptionally comprehensive. The breadth of faculty research interests results in a wide range of available laboratory equipment for population samplings, radiotelemetry, nutrient and caloric analysis, electrophoresis, gas analysis, and environmental monitoring. Controlled experiments can be conducted in greenhouses and animal rooms. Large computer facilties provide readily available support for teaching and research. The Illinois State Natural History Survey, a separate state agency, is located on the campus and provides collaborative facilities for ecologically-oriented research. The

Survey has research collections, modern laboratory facilties, field research stations, and a large staff working in the area of systematics and ecology of Illinois flora and fauna, both terrestrial and aquatic. Extensive research collections are also maintained by the School of Life Sciences in the Museum of Natural History and the Herbarium of the Botany Department.

Financial support for graduate students is available in the form of fellowships and teaching and research assistantships. Fellowships are awarded to outstanding graduate students in the School of Life Sciences. Teaching assistantships are offered after competitive review by the various departments providing ecological training and by the School of Life Sciences. Research assistants may be obtained through contact with specific faculty members who administer funds provided by research grants. All assistantships and fellowships provide exemptions from payment of tuition and regular fees.

Requests for additional information should be directed to the heads of the specific departments or the Chairman of the School of Life Sciences Ecology Program.

ENVIRONMENTAL EDUCATION WITHIN THE INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES, UNIVERSITY OF NEBRASKA-LINCOLN

by Roger E. Gold*

Since Rachel Carson dropped what has been described as her "blockbuster" paperback in 1962, springs in rural America have been anything but silent. They have reverberated to the anguished pleas of environmentalists to "stop the deadly spraying," and to the equally anguished pleas of farmers who depend on rather massive applications of pesticides and herbicides to feed the world. Some order is beginning to emerge from the conflict. In this case study you see the slow but steady progress of the agricultural education establishment in mounting a multi-faceted program encompassing certification training of applicators, a state pesticide advisory committee, a national pesticide information assessment agency, the registration of pesticides for "minor use", and a trend toward alternative methods of pest management. At the University of Nebraska the program is under the supervision of a new Environmental Programs arm of a comparatively new Institute of Agriculture and Natural Resources. But this case study is more than a detailed account of movement on the pesticide education front; it is an overview of the manifold interdisciplinary teaching, research, and extension activities with an increasing environmental tilt in that remarkable American invention, the land-grant college, facilitated at Nebraska by a special Coordinator.

Introduction

In the process of assembling information for a case study of environmental education it seemed basic, but imperative, that the concept of "environment" be defined. The evolution of the various concepts of what constitutes "environment" makes an interesting study in itself; however, for these purposes "environment" is understood to be "the system of interrelationships among society, economics, politics, and nature in the use and management of resources".

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Recognition of environmental problems and support for educational programs that emphasis environmental concerns have been apparent in Nebraska for the past several years. The state's economy is closely tied to agriculture, and the state's farmers and ranchers consider themselves to be the "original environmentalists" in expressing their concerns for the environment in being "conservationists" and "stewards of the soil". The general citizenry of the State also appear to be environmentally aware, as indicated in a recent survey conducted by the Bureau of Sociological Research of the University of Nebraska. This 1977 survey indicated that the majority of Nebraskans are aware of environmental problems within the State. The majority of those persons contacted showed the highest concern for water shortages, soil quality and water pollution; and were somewhat less aware of air pollution, oil, electricity, natural gas and other natural resource limitations. It was interesting that the awareness of those polled depended partly on where they lived. City residents believed air and water pollution and natural resources depletion to be more of a problem than did other residents of the State. The people who were aware of environmental problems tended to be younger, better-educated, politically active, and had children at home as compared with Nebraskans who were not aware or showed little interest in envirronmental issues. The fact that those who were aware of these problems were the younger, more active and better-educated citizens of the State was interpreted to mean that environmental issues will receive much more attention in the future.

The continuing support for both agriculture and environmental education has been expressed through the actions of the State Unicameral Legislature with the creation in 1974 of the Institute of Agriculture and Natural Resources (IANR) at the University of Nebraska - Lincoln. The Institute was established with five divisions, each with a dean or director reporting to the Vice Chancellor for Agriculture and Natural Resources. A sixth division, that of International Programs in Agriculture and Natural Resoruces, was added to IANR in July 1976. This legislative action thus expanded the College of Agriculture and formally recognized the role that the College had been serving in agriculture, as well as in the natural resources arena. The six divicions of IANR are: College of Agriculture (Undergraduate Resident Instruction) including the School of Technical Agriculture (a two-year vocational-technical school); Agricultural Experiment Station; State Cooperative Extension Service; Conservation and Survey Division; Nebraska Water Resources Center; and International Programs in Agriculture and Natural Resources. Each of these divisions within IANR has been directly involved in formal instruction or dissemination of information concerning environmental issues. Also included within the Institute is a vast resource in terms of general information, data, and expertise that is available to all Nebraskans through the many outreach programs of the University.

Statewide programs are conducted from 13 departments that are headquartered on the East Campus in Lincoln. The majority of these departments are involved in all three of the major functions (teaching, research, and extension) under the administration of department chairmen. These chairmen are responsible for planning and coordination of all activities in their specific disciplines throughout the State. The State of Nebraska is divided into five research and extension districts. Each district program is under the administrative control of a director who is responsible for program planning and coordination. The district programs involve both research and extension activities oriented toward the particular needs of the region. The overall program is coordinated, however, by discipline with the statewide programs through the respective department chairmen located in Lincoln. Approximately half of the Institute staff is stationed off the Lincoln campus in other locations over the State. A total of 88 county extension offices are maintained to provide outreach programs to the 93 counties within the State, with a staff of 101 agricultural agents, 68 home economics agents, and 110 extension specialists. The 136 research scientists assigned to the Agricultural Experiment Station are located in 12 major research facilities. The College of Agriculture (Resident Instruction) has 59 full-time positions (FTE) to support the formal teaching efforts. Many IANR faculty members have split appointments with part of their workload in teaching, part in research, and part in extension, or any combination of the three. The split appointments have helped to foster interdisciplinary approaches to problem resolutions within the Institute.

In preparing a "Case Study" of environmental programs in education within the Institute of Agriculture and Natural Resources, it became apparent that each of the six divisions have ongoing programs that emphasize different aspects of environmental issues. Whereas it would be impossible in a review of this type to discuss in detail each of the projects that has an environmental theme, an attempt is made to discuss the general emphasis and activities of each of these divisions. Finally, in more detail the activities of a new working group called "Environmental Programs" are described.

College of Agriculture (Resident Instruction)

The College of Agriculture is responsible for Resident Instruction Programs within the Institute of Agriculture and Natural Resources. A record number of undergraduate students is enrolled at the present time (1657), with course demands at an all-time high. The College also continues to provide strong graduate education coordinated through the Graduate College. The principal areas in which students are majoring, among a total of 14, include Animal Science, Agricultural Economics, General Agriculture, Natural Resources, Agronomy, and Agricultural Education. Several of the majors offered by the College have options for the students that allow them to emphasize their interests in environmental programs. Among the majors offering options of this type is Natural Resources. The options available include: Wildlife Management, Water Resources, Recreational Resources, Range Management, and Soil Conservation and Survey. At the present time approximately 200 students within the College have declared Natural Resources majors.

Professional preparation is changing for the College because of several major influences. First is the continued rapid changes taking in technology and economics which must be reflected both in the revision of existing courses and in the introduction of new courses. More emphasis is being placed upon a systems approach in answering problems and making decisions relating to agriculture and natural resources. The second major influence is the changing composition of the College student body. A greater proportion of the College's students are coming from urban backgrounds. Surveying the freshmen in the fall of 1976, 40 percent came from an urban background rather than from rural. There has also been a trend for students entering the College to have scored higher on the ACT tests than in years past. These trends have had a strong influence on the type of professional agricultural preparation undertaken in the College of Agriculture. In many cases new courses that are not "traditionally agricultural" have been instigated within the College. There has been an increasing emphasis on laboratory training, special problems dealing with hands-on experience, internships, and field trips. This is reflected in some curricular changes and new programs that would include an Insect Integrated Pest Management option within the Department of Entomology, and an Agronomy Summer Internship, as well as the expanded use of special problems in independent studies conducted off campus through coordinated efforts of industry and state and federal agencies.

Within the College is the administrative responsibility for the University of Nebraska School of Technical Agriculture (UNSTA). This two-year vocational/technical school is located in Curtis, Nebraska and is involved solely in agricultural technological programs. Six programs of instruction are presently offered. These include: Agricultural Business Technology; Agricultural Land and Water Technology; Agricultural Machinery and Mechanics Technology; Commercial Horticultural Technology; Production Agricultural Technology; and Veterinary Technology. Students specifically interested in environmental resources are directed to the Agricultural Land and Water Technology curriculum. This includes two years of instruction in the areas of engineering, soil and water conservation, irrigation, pollution control, water resources development, and land improvement construction.

Agricultural Experiment Station

The Agricultural Experiment Station was established through the Federal Hatch Act of 1887 as a part of the land-grant college system. The Experiment Station was to be engaged in the systematic scientific study of problems relating to agriculture and family life in Nebraska. It was the intent of Congress in establishing the agricultural experiment station system to assure agriculture a position in research equal to that of industry. Section 2 of the Hatch Act states, "It shall be the object and duty of the State agricultural experiment stations through the expenditure of the appropriations hereinafter authorized to conduct original and other research, investigations, and experiments bearing directly on and contributing to the establishment and maintenance of a permanent and effective agricultural industry of the United States, including researches basic to the problems of agriculture in its broadest aspects, and such investigations as have for their purpose the development and improvement of the rural home and rural life and the maximum contribution by agriculture to the welfare of the consumer, as may be deemed advisable, having due regard to the varying conditions and needs of the respective States." Federal Hatch support for the experiment stations have served as an incentive for additional non-federal support to carry on essential research. These additional monies are provided by the State of Nebraska and from grant monies from industry and other granting agencies.

The research conducted by experiment station staff has direct application to the farmers and ranchers of the state as well as to the general citizenry. At the present time, there are approximately 225 separate projects conducted by station scientists. The information derived from these investigations is published in annual reports, bulletins, outstate testing circulars, quarterly articles, departmental reports, and journal articles. These scientists are also involved in seminars and in the presentation of their data and information at professional meetings. Through these mechanisms, the data and results eventually make their way into the classroom and to the extension agents and specialists who teach and demonstrate the principles throughout the State in outreach programs. Many of the research scientists assigned to the Experiment Station have split appointments in research, instruction and extension which facilitates the flow of current information. The graduate programs in the Institute are also closely associated to the research being conducted by Experiment Station staff.

A large percentage of the research projects reported in the Annual Report of the Nebraska Agricultural Experiment Station emphasized an environmental theme. This last year station scientists from the Agricultural Engineering Department, in cooperation with the Massachusetts Institute of Technology, constructed at the Institute's field laboratory in Mead, Nebraska the largest solar-cell powered irrigation system on earth. This system is currently being used to irrigate 80 acres of corn and soybeans.

Other scientists are investigating new sources of food or more efficient methods and technologies to produce commodities with less disruption to the environment and with the use of less non-renewable natural resources. Plant and animal selection breeding programs are working for lines that are tolerant and resistant to pest attack or that can survive under adverse conditions. In this regard, the Station released new varieties of corn hybrids, and alfalfa this past year.

IANR has received grants from the Old West Regional Commission to provide access to the AGNET Computer Network. AGNET's programs run the gamut from dietary analysis to irrigation scheduling and will allow scientists as well as extension and teaching personnel to share information and resources on a multi-state basis.

Nebraska Cooperative Extension Service

The Nebraska Cooperative Extension Service of the Institute of Agriculture and Natural Resources is a cooperative program with the Federal Extension Service of the United States Department of Agriculture (USDA). Its purpose is to take information to the people of Nebraska that will help them with the solution of their problems. The extension agents and specialists had more than 1.5 million contacts with Nebraskans during 1977 through meetings, workshops, and personal consultations across the State. These contacts provided educational information and opportunities dealing with agriculture and natural resources, home economics, youth development, and community resource development. Information has been made available through the Extension Service publications, demonstrations, and by other means of communication including television and radio broadcasts as well as videotape systems.

The Cooperative Extension Service in Nebraska has for several years recognized its responsibility to provide relevant information to the people in the State dealing with natural resources, environment, and energy issues. Several of the successful programs have been recognized both within the State and nationally. Specialists in home economics have prepared exhibits that have dealt with "Energy Conservation in the Home". They have included in their presentations subjects such as the "R" values of insulation and possible uses for solar collectors. At least 10,000 Nebraskans have become aware of the needs for energy conservation in the home as a result of these various exhibits. In-service training on energy has been conducted for 120 county and area extension agents in Nebraska. These training sessions titled "Energy - Past, Present, and Future" help the various agents and specialists to plan specialty meetings which emphasize energy conservation when presented in their counties or districts.

Agricultural agents have emphasized in their outreach programs that fertilizer applications should be made according to specific soil test recommendations. Since fertilizer supplies are limited (derived from non-renewable natural resources) and expensive, the soil testing procedures have increased three-fold in the major sugar beet-growing areas of the State and are gaining acceptance by the wheat and rowcrop farmers. Through the emphasis of soil testing procedures, the amount of fertilizer utilized may in some cases be reduced significantly while at the same time maintaining maximum yields. An environmental benefit derived from reduced fertilizer application comes through reduction of the amount of these agricultural chemicals that make their way into the groundwater supply.

The Extension Service has also been involved in the successful demonstration of "off-peak irrigation". Irrigators in the demonstration areas agreed to have their pumps turned off by radio control from headquarters installations during peak water use hours. As a result, the summer peak was reduced in the cooperating areas. Besides saving electrical energy and money, the farmers learned that they could produce high yields with less water when proper water management principles and practices were initiated. These programs have been so successful that in one irrigation district there has been no need for the construction of additional irrigation units.

Reduced tillage has been an important part of research and extension program efforts in Nebraska for 15 years or longer. The benefits of the Nebraska Till-plant system in reducing the number of field operations has resulted in conserving energy and moisture, reducing cost of production, and reducing soil erosion. In more recent years, variations of the Till-plant system have been adopted by Nebraska farmers, and the once standard practice of plowing, discing, and harrowing fields prior to planting has almost disappeared in many areas of the State. Other types of reduced tillage operations including slot-planting, or non-tillage, have also been demonstrated by extension specialists and agents. Reduced tillage using "Ecofallow" systems have been adopted in southwestern Nebraska. "Ecofallow" involves the application of chemicals to control weeds in wheat stubble. The stubble is not tilled following harvest and corn or sorghum is planted the following spring. This system saves fuel, moisture and time, protects against erosion, and produces higher yields than other cropping systems used in that area.

The use of water meters and moisture blocks have aided in irrigation scheduling. These procedures have been demonstrated and encouraged for several years by extension agents and specialists. In most cases farmers apply less water and save energy when they follow an irrigation scheduling procedure. State extension specialists estimate that half the energy used for irrigation could be saved if all irrigators scheduled their irrigations according to the plant consumption views. Intense water management programs have been designed to demonstrate that farmers can reduce water applications while maintaining adequate production. Educational meetings and demonstration of irrigation scheduling conducted by Cooperative Extension Service staff across the State have resulted in water and energy savings of 20-35% for most of the operators participating in these projects.

The Nebraska Cooperative Extension Service was designated as an exclusive agency responsible for the training of commercial and private applicators of "Restricted Use Pesticides". This training effort was called for under the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended in 1972 and 1975. During the past year, county extension agents and specialists trained 37,197 private applicators and 4204 commercial applicators. This massive training effort has helped increase the level of knowledge concerning the use of these agricultural pesticides, and hopefully will help to prevent the misuse of these products which could potentially harm non-target organisms in the environment.

More than 50,000 Nebraska youth between the ages of 9 and 19 participated in individual and group learning activities of the 4-H Youth Development Program of the Cooperative Extension Service during 1977.

Figure I. A Summary of Time Spent by Cooperative Extension Agents and Specialists in Outreach Programs Emphasizing Environmental Education

		1970	1971	1972	1973	1974	1975	1976*	1977**
Pesticide Education and Safety	Days	231	231	322	193	136	213	341	1871
	FTE	1.02	1.02	1.42	.85	.60	.94	1.51	8.28
Pollution Control	Days	384	687	755	411	312	250	403	219
	FTE	1.70	3.04	3.34	1.82	1.38	1.11	1.78	.97
Natural Resources Protection	Days	1530	1521	3081	1896	1639	1812	2044	1979
	FTE	6.77	6.73	13.6	7.06	7.25	8.02	9.04	8.76
TOTALS	Days	2145	2439	4168	2200	2087	2275	2788	4069
	FTE	9.49	10.79	18.44	9.73	9.23	10.07	12.34	18.00

225 Day = 1.0 FTE

* 1976 represents a 15-month period July 1, 1975 through September 30, 1976. This was done to allow change in federal fiscal year.

** 1977 date = 11 months reported (not complete for total 11 months).

Many of the activities and programs conducted with the 4-H youth involved themes which emphasized the conservation of natural resources and concern for the environment. The spin-off from these types of programs is difficult to document because of the multiplier effect that comes in working with youth. There is strong evidence that the pamphlets and other project materials have made their way into the Nebraska school systems to be shared with the rest of the youth of the State.

As a summary of the efforts that the Cooperative Extension Service has expended in the area of general environmental education, Figure I has been provided. Only those programs that emphasized pesticide education and safety, pollution control, or natural resources protection were retrieved in this computer scan.

Conservation and Survey Division

The Conservation and Survey Division is that division of the Institute scientifically oriented toward basic and applied earthscience research. Created in 1921 by act of the State Legislature, this division has involved itself in research and service which for more than half a century has conducted surveys and investigations about Nebraska's natural resources. The emphasis of the division has been to analyze and synthesize the geologic history of the State in order to contribute both to the economic growth of the State and to the scientific growth of knowledge. A data base has been developed for a variety of natural resources in the State. This data base provides a wide range of information on water availability, water quality, soils and their uses, weather, mineral resources including oil, gas, and other geologic information.

While some scientists are gathering hydrologic and geologic information from depths as great as 10,000 feet, others are collecting data from the Earth Resource Technology Satellite. From the new remote sensing center, administrative part of the Conservation Division, comes information that enables staff members to inventory such things as the state center pivot irrigation systems, wetlands, land use activities, and fault lines that could affect dam sites, nuclear power plants, and other structures.

All of the various survey activities are based by necessity upon the collection and organization of natural resource data well in advance of their use for management, planning, and development. Because of its service and research orientation, the division has been able to maintain a high degree of objectivity toward its base-data collection. The availability of this material has provided an effective resource to University faculty and graduate students. Retrieval of the vast amounts of data collected by the water survey has been facilitated by a computer-oriented program in cooperation with the United States Geological Survey. More efficient storage and utilization of geological information is being established through the University Computer Center. Groundwater development and management, county soil surveys, and land-use inventories are examples of current programs in which the newly created Natural Resources Districts have had an active interest in working cooperatively with the Conservation and Survey Division.

The Information Bureau Service has been a major activity of the Conservation and Survey Division. Staff members participate through publications and consultations with individuals and public and private organizations. This service plus the educational leaflets, bulletins, and displays have been an effective method of informing the general public of the knowledge gained from the Institute's research concerning Nebraska's natural resources.

Nebraska Water Resources Center

The Nebraska Water Resources Center (NWRC) was established as a result of State and Federal actions authorized by the Water Resources Research Act of 1964. This center has evolved into a major force impacting on several categories of critical water problems facing the State. The center's current program reflects concern for basic and applied research and for the development of mechanisms for efficiently translating research results into appropriate action.

The missions of the center are to foster, coordinate, administer and conduct research as well as to disseminate information, conduct and sponsor educational and training activities which are responsive to the needs of Nebraska. The major role of this center is through coordination to stimulate and guide the efforts of those in the State with interest and responsibilities in water resources research and education.

The Nebraska Water Resources Center has sponsored educational activities which include interdisciplinary water resources seminars on "Water Resource Planning and Management" offered for one or two credit hours during the spring semester. Two research overviews outlining the center's water resources research programs have also been held. The center has also been involved in the development of courses in hydrology and water resources taught to civil and agricultural engineers, undergraduate and graduate students. Information exchange sessions on artificial recharge, hydrologic modeling and various other topics have also been sponsored.

The Water Resources Center is also involved in information dissemination. A bimonthly newsletter outlining the water resource activities in Nebraska and elsewhere is mailed both locally and nationally. The Center periodically distributes a publication list describing recent water resource-related library acquisitions available for loan to interested persons. Various staff members from the center have also been involved in presenting a number of seminars to various groups throughout the State in discussing Nebraska water problems and the work of the center.

The director of the Nebraska Water Resources Center, in addition to serving in his normal staff functions, also serves on various committees and advisory boards to State agencies within Nebraska. He has recently been appointed to the Governors' Drought Task Force, is an advisor to the Nebraska Natural Resources Commission, and is a member of the Advisory Board for the Nebraska Conservation Program. The center's staff are also involved in natural water resources policy making. The director and various members of the staff have been involved in both state and national committees dealing with water policies that influence both research and education.

International Programs in Agriculture and Natural Resources

In the Institute of Agriculture and Natural Resources the international aspects of teaching, research, and extension are receiving more formalized attention. Specific grants and contracts have provided staff development and experience opportunities in Russia, China, Yugoslavia, Romania, Poland, Morocco, Afghanistan, Sierra Leone, Liberia, Brazil, Israel, and Mexico. These experiences reflect increased breadth, and affect us in teaching and extension programs related to the interdependence of Nebraska, the United States, and the World in modern food and agriculture situations. In agricultural research the mutual benefits of international collaboration are demonstrated by our scientists in such fields as wheat breeding, sorghum physiology, irrigation technology, land-use, and the use of agricultural chemicals. Several major international program grants have already yielded advantages in terms of new technology available for Nebraska agriculture.

Environmental Programs

Environmental Programs, a new administrative unit within the Institute of Agriculture and Natural Resources, was established with the hiring of the first Coordinator in August 1977. The Coordinator's position and budget were provided with state monies appropriated by the 85th Unicameral session in the same year. This working unit was set up as an independent entity with a separate budget and primary accountability to the Vice Chancellor for the Institute. It was anticipated that this independence would allow the Coordinator to promote interdisciplinary approaches to problem solutions which may not have occurred had he been assigned to an existing academic department. The Coordinator was given a split appointment with responsibilities to extension, research, and resident instruction. This division of time and responsibility has been well received, as it has fostered a good working relationship with the faculty and administration of these key divisions of the Institute.

As conceptualized by the administration of IANR, Environmental Programs would serve to coordinate environmental activities within the Institute with particular attention being paid to the possibilities for interdisciplinary work in pest management, training of pesticide applicators, waste disposal, pollution control, and other related areas. The position description called for the creation of mechanisms to facilitate information exchange on environmental topics among the units and faculty of IANR and to serve as the liaison between the Institute and other Divisions and Colleges within the University. A liaison was also to be established between the Institute and other state and federal agencies involved in environmental affairs.

Besides having a very general position description, the challenge was also offered to establish these Environmental Programs within and among the existing departments in the six divisions of the Institute. As has been documented, there were several ongoing programs concerned specifically with the environment already in place and functioning prior to the initiation of Environmental Programs. It was initially not clear how the interlacing of program areas would be accomplished. It can be stated that even though Environmental Programs are still in the formative stages the transition has gone smoothly as more and more responsibilities have been assumed by the Coordinator.

In order to accommodate the melding together of existing programs, ground rules were established at the onset. Perhaps foremost was the principle that Environmental Programs would be involved with the coordination, not the control, of environmental involvements within the Institute. Every effort would be made to utilize existing resources in terms of scientists and extension specialists assigned to departments, and that when grant or contract monies were available that they would be used to compensate departments for their involvements. And lastly, every effort would be made to communicate in advance any proposed actions to the departments or divisions that would potentially be involved in proposed program areas.

Working with these guidelines has not always been the most efficient approach to problem resolution, but many problems have been avoided by being open and communicative.

Before the initial problems of establishing an office and hiring secretarial help could be resolved, the first of the requests for assistance was received. It soon became apparent that a backlog of items needing attention had accumulated since it was announced that an Environment Coordinator would be on staff. Several of these issues were very sensitive, particularly in the areas of pesticide programs. It had been theorized that these issues would best be handled by a "neutral" office. Within a very short period of time the Coordinator for Environmental Programs was dubbed with many new titles and responsibilities which included State Pesticide Coordinator, State Environmental Coordinator for USDA Liaison, IR-4 Pesticide Minor Use Registrations Coordinator, National Pesticide Information Assessment Programs (NPIAP) Coordinator, Pest Management Coordinator and Liaison to the Nebraska Natural Resources Commission. The new Coordinator was also given the opportunity of serving on the Ad Hoc Institute Energy Committee and the Committee for Water Resource Management.

It became apparent that the initial program thrust was for Environmental Programs had already been established and what was needed was a coordinated approach to the resolution of some of the more pertinent issues. The approaches taken are discussed on an individual basis below.

I. Pesticide Programs

A great deal of interest and concern has been expressed by both agricultural and environmental interest in the continued availability and use of pesticides. Due to some of the recent amendments to the Federal Insecticide, Fungicide, and Rodenticide Act a major program thrust has resulted which emphasizes pesticides. Among those programs undertaken are:

A. Certification Training

The Federal Insecticide, Fungicide, and Rodenticide Act calls for the certification of all applicators of what are termed "Restricted Use Pesticides". Each state including Nebraska has undertaken through the Cooperative Extension Service training programs to assist both private and commercial applicators of "Restricted Use Pesticides" to meet the State and Federal certification requirements. The Coordinator for Environmental Programs has been assigned the overall responsibility for the certification training effort. In the State of Nebraska, the training programs had been designed and conducted by a Certification Training Coordinator (an extension specialist). Through the services of the District Extension Specialists and County agents these programs were delivered to the residents of the State. Slide sets, training manuals and other materials have been developed to assist in these training efforts. An advisory committee has been formed with representatives from the Institute, the pesticide industry, and agricultural organizations to assist in developing guidelines for these federally mandated programs.

B. The Institute Pesticide Advisory Committee

The Vice Chancellor for Agriculture and Natural Resources established an Institute Pesticide Advisory Committee with the Coordinator for Environmental Programs serving as chairman. The committee membership is made up of representatives from each of the agricultural departments within the Institute and a representative from the State Department of Agriculture. This advisory committee serves to make recommendations concerning pesticides to the administration within the Institute. The committee also serves in an advisory role to both state and federal agencies. As an example, the Federal Insecticide, Fungicide, and Rodenticide Act provides that the Nebraska State Department of Agriculture has the authority to register pesticides for "Special Local Needs", provided that the request for registration has been reviewed by a technical advisory committee. The Institute Pesticide Advisory Committee, therefore, acts in this capacity in making recommendations to the Department of Agriculture. The same procedure is utilized in reviewing "Emergency Exemptions" for pesticide registrations made by the same state agency. The Charter for this advisory committee provides for meeting on an Ad Hoc basis at the request of the chairmen or two members of the committee.

C. National Pesticide Information Assessment Programs (NPIAP)

As a part of the registration and re-registration activities for pesticide products regulated by the Environmental Protection Agency (EPA) certain pesticides which are believed to cause unreasonable risks to man or the environment are subjected to a Rebuttable Presumption Against Registration (RPAR) process. This review process is provided for in the provisions of FIFRA and could eventually result in the suspension and/or cancellation from sale and use of candidate pesticides. All available data representing both the risks and the benefits derived from the use of candidate pesticides must be analyzed before the decision for cancellation or re-registration can be made. The process whereby these specific data are collected is known as the National Pesticide Information Assessment Program. The particular program utilizes a multi-agency approach involving the United States Department of Agriculture (USDA) and the Environmental Protection Agency (EPA). In each state a NPIAP Coordinator has been designated to collect and disseminate information concerning pesticide uses and risk/benefit analysis. In the State of Nebraska, the Coordinator for Environmental Programs serves as the NPIAP representative. The specific request for information on candidate RPAR chemicals are handled by scientists and extension specialists from within the Institute. These activities are coordinated through Environmental Programs to insure that the proper disciplines are contacted in responding to the specific data needs. As an example, if an insecticide is involved it is handled through the scientists and extension specialists within the Department of Entomology, whereas herbicides would be handled through the Departments of Agronomy and Horticulture. Grant funds have been provided to support these survey and assessment activities. These grant monies are assigned to Environmental Programs, but are distributed to the individual departments submitting data on a contract basis.

D. Pesticide Registration for Minor Use

The research and Development cost of preparing a pesticide to meet federal requirements for registration has become so great that pesticide manufacturers often times do not undertake the collection of data to support uses on "minor" or "specialty" crops. There are a number of commodities or uses for which there are no legally registered pesticides. The federal pesticide law is specific on the point that pesticides may only legally be used in situations that are indicated on the label directions. This strict interpretation of the federal insecticide law serves to protect man, animals, and the environment, but at the same time has created problems for persons who may need to protect their crops, animals, or structures from invading pests. The USDA in order to resolve this issue has instigated an IR-4 Program for the registration of "minor use" pesticides. Each state has an IR-4 Coordinator, which in the State of Nebraska is the Coordinator for Environmental Programs. Requests for information and the collection of data for IR-4 Programs are processed by Environmental Programs which in turn directs them to the appropriate scientists and extension specialists. This procedure allows the specific subject matter specialist to have direct input into the decisions that are made concerning the "minor use pesticide registrations" that are needed in Nebraska.

E. Integrated Pest Management

Both the United States Department of Agriculture and the Environmental Protection Agency have in recent years supported Integrated Pest Management Programs which provides a localized comprehensive systems approach to achieving economical pest control in an environmental sound manner. The objectives of Integrated Pest Management Programs are: (1) to develop and implement effective integrated programs to prevent or mitigate losses caused by pests through use of biological, cultural, chemical, and varietal methods of control; (2) to implement practical methods for monitoring pest population in farmers fields; (3) to provide farmers and others in the private sector with the information and training necessary to put into practice the principles of integrated pest management. The legislative intent of Congress is that there be a commitment to "reduced pesticides usage".

The Extension Service of the USDA through the State Cooperative Extension Service has for the past several years been involved in the promotion and funding of pest management projects. The Cooperative Extension Service in each state has provided a Coordinator for Pest Management Programs. In the State of Nebraska this coordinator is the Coordinator for Environmental Programs. In order to assist in the coordination of Pest Management Programs, an advisory committee has been formed. The State Pest Management Advisory Committee has representatives from the various departments from within the Institute as well as from state agencies, environmental groups, the chemicals industry, and growers organizations. This advisory committee reviews all pest management proposals and makes decisions through an evaluation process on which proposals will be funded with state-designated monies. The grant monies come from federal agencies, usually the USDA or EPA, and are administered through Environmental Programs to the departments and individual investigators involved. The State Pest Management Advisory Committee is also involved in the annual evaluation of each pest management project. The State of Nebraska has three ongoing Integrated Pest Management Programs including the Control of Livestock Insects, the Control of Insects of Corn and Sorghum, and the Control of Small Rodents (including mice and rats).

II. Environmental Program Coordination

At the present time, pesticide programs are taking the major portion of the time and resources assigned to Environmental Programs. However, there are a number of other activities that are being conducted concurrently.

A. Liaison on Environmental Programs to Federal Extension

The Federal Extension Service has a program leader specifically designated to disseminate information to the states concerning ongoing environmental programs at the federal level. The federal coordinator sends this information to state representatives who in turn channel it through the state information systems. This has been accomplished by means of news releases and newsletters.

B. Liaison to State Agencies

The Coordinator for Environmental Programs has been serving as a liaison between the Institute, state agencies, and interest groups. The coordinator has had the opportunity of serving on the advisory committee to the Natural Resources Commission (State Lead Agency for enforcement for the Federal Water Pollution Control Act), the Department for Environmental Control (responsible for the enforcement of several federal acts dealing with environment, including air and water), the Department of Agriculture, and the Rural Development Committee. The involvement of Environmental Programs with these state agencies has been to serve in the capacity of technical advisor and to provide for the coordination and involvement of scientists and specialists from within the Institute when called upon.

III. Information Dissemination

The key to the coordination of environmental programs comes through dissemination of current and relevant information. This is being accomplished through the participation of the coordinator and staff members in various training programs, seminars and conferences. A newsletter will be initiated in the near future that will have a wide distribution in Nebraska dealing with general environmental topics. A small library will be maintained in specified subject areas, the Federal Register and other periodicals for use by the faculty, staff and students of the Institute. Through the Department of Agricultural Communications news releases and technical bulletins will be produced and disseminated as needed.

IV. Resident Instruction

At the present time Environmental Programs will not be involved directly in the offering of courses dealing with environmental education. The Coordinator for Environmental Programs, however, does have a portion of his appointment assigned to resident instruction. A course has been proposed and approved to be taught in the spring semester of 1978 titled "An Introduction to Pesticides and Their Use". This course will deal specifically with the factors that must be considered in making decisions to use toxic chemicals in the control of pest populations. A major portion of the course will be spent in discussing the externalities and benefits derived from the use of agricultural chemicals. The course will be offered through the College listing rather than a department, in order to encourage both agricultural majors and non-majors to participate. Other courses at the college level are being developed to deal with the involvement of agriculture in the total environment.

Summary and Comments

The Institute of Agriculture and Natural Resources through its six divisions and 13 academic departments offers a wide range of opportunities, resources, and formalized instruction to students pursuing interests in environmental education. Through the Cooperative Extension Service information concerning the environment is being delivered by agents and specialists who contact many thousands of individuals with outreach programs every year.

Man's relationships with his environment and his impact on that environment are subjects of increasing public concern. Because interest in the environment crosses traditional academic structures in many complex ways, Environmental Programs of the Institute of Agriculture and Natural Resources was established in August 1977. This new unit has provided an interdisciplinary approach to problem resolution, and has served as a liaison between the Institute, other agencies and individuals interested in environmental issues. The information presented in this Case Study outlines the initial activities in the first five months of Environmental Programs. Out of necessity, the major program thrusts have involved pesticides and pesticide-related issues. The Charter for Environmental Programs does provide, however, for expansion to other areas as resources permit. At the present time, it is not anticipated that a curriculum will be developed for environmental education through the Department for Environmental Programs.

The coordinator and other staff members will, however, be involved in the offering of courses at the college level and will participate in seminars and other educational forums to assist in the ongoing programs within the College of Agriculture that emphasis environmental themes.

THE DEPARTMENT OF ENVIRONMENTAL SCIENCES AT UNIVERSITY OF VIRGINIA

by H. Grant Goodell*

Growing out of conventional geography and geology departments, the University of Virginia's Department of Environmental Sciences now includes a 27-member faculty from such diverse "hard science" fields as meteorology, climatology, ecology, hydrology, soils, and water resources. Initially offering work only at the graduate level, the Department now also presents three levels of undergraduate instruction. Wide-ranging departmental research projects lend depth to the rigorous academic program which focuses on educating two types of persons: those who wish to acquire a broad understanding of basic environmental phenomena and processes, and scientists who can make effective contributions to the fundamental knowledge of environmental systems.

Introduction

The implications of man's interactions with the environment are so complex that they cannot be understood from the viewpoint of a single scientific discipline. Thus, in 1969 the University of Virginia established a new interdisciplinary Department of Environmental Sciences within the College of Arts and Sciences to further the understanding of natural and human environments, to foster scientific analysis of environmental issues and problems, and to develop a rigorous academic program for students interested in a comprehensive approach to questions of environmental quality. The antecedent of the new department were the Departments of Geology and Geography, neither of which offered work beyond the Master's level. Most of the former faculty left the University at the time of merger. New faculty were added in meteorology, climatology, ecology, and hydrology and particular emphasis was placed in recruiting faculty with such hybrid backgrounds as biometeorology, soils ecology, and hydrology/water resources. A graduate program leading to the Doctor of Philosophy was started in 1971.

Our initial instincts were to emphasize graduate education. This was in keeping with the University of Virginia's emphasis in the Commonwealth and with our own conviction that an environmental scientist

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had to have a thorough background in at least one of the more traditional natural sciences in addition to a broad holistic view of environmental systems. However, the department immediately began to attract substantial numbers of undergraduates until today they number more than 200, of which a third are headed for graduate school in the sciences, a third to graduate professional schools. The last third are terminal baccalaureate degrees who seek opportunities in environmentally-oriented professions, planning, engineering, consulting or government. Therefore, the department attempts to educate two types of persons: (a) those who wish to acquire a broad, thorough understanding of basic environmental phenomena and processes, and (b) scientists who can make effective contributions to the fundamental knowledge of environmental systems. Both should be capable of becoming managers and administrators in positions which require an ability to evaluate the environmental impact of decisions in government and industry.

Undergraduate Programs

The department has three levels of undergraduate instruction. For students majoring in other fields but interested in the environment, several first- and second-year courses are offered that cover man's relationship with the environment. These satisfy the science requirement of the College of Arts and Sciences. Students who wish to major in Environmental Sciences are required to take four core courses (Fundamentals of Ecology, Physical Hydrology, Atmosphere and Weather, and Environmental Geology, each of which has a laboratory) and 14 additional hours in the department. These may be selected from the more than 48 undergraduate courses presently offered. The department additionally requires calculus and one year of chemistry or physics or biology. Students who seek a terminal Bachelor's degree may elect to take such other courses outside the department as are applicable to their interests and probable vocations. Students who aim for graduate school and a professional scientific career are counseled to concentrate their coursework in the area in which they propose to do graduate work and to take additional courses in physics, chemistry, biology, mathematics and economics.

Graduate Programs

The department offers the graduate student an integrated interdisciplinary approach to environmental sciences. This integration requires a basic background in the physical and biological sciences and in mathematics. Graduate students are expected to obtain an early mastery of the subject matter covered in the core undergraduate courses offered by the department and to become proficient in systems analysis and simulation modeling. These subjects are stressed in many departmental courses and offer a common ground for interdisciplinary communication.

While the environment as a whole is the focus of the program, each graduate student is expected to specialize in at least one of the sub-fields in which the department excels: meteorology, environmental geology, ecology or hydrology. In addition, there are two programs, environmental chemistry and resource management, which may be combined with one of the four major areas for further specialization. This allows a student, for example, to create a program in water resources management or atmospheric chemistry.

The graduate student entering from another university normally has a degree in one of the classical disciplines. The student's first year is spent broadening his background with courses selected principally from the other areas of the department. The remainder of the graduate courses are prescribed by the faculty directive committee depending on the student's thesis or dissertation research.

Meteorology: The growth in population and technology throughout the world has placed increased demands upon the scope and quality of weather prediction. The complicated non-linear system that is the atmosphere is being described with increasing precision through the use of sophisticated observational tools, physical modeling and mathematical methods. The atmospheric scientist will be called upon to interpret atmospheric behaviour in terms of these specialized tools over a greater and greater range of problems. The meteorology option in the Department of Environmental Sciences provides this training in atmospheric behaviour within the context of the broader environmental system.

The option in meteorology rests upon the basic dynamics, thermodynamics and energetics of the atmosphere. Applications are pursued in synoptic meteorology, hydrology and climatology. At the baccalaureate level, training is commensurate with the requirements of the national weather services. Qualified undergraduates, particularly those who wish to become professional scientists, are encouraged to select elective courses from the advanced level offerings in environmental sciences and additional courses at the undergraduate and graduate level in mathematics, physics, chemistry and engineering.

At the graduate level, coursework is focused more on the theoretical aspects of atmospheric phenomena such as the thermodynamics and geophysics of circulation at all scales, radiation budgets and heat transfer within the atmosphere and between the atmosphere and the surface, and the mathematical modeling of atmospheric systems. The theory and application of weather modification and management, microclimatology, and satellite meteorology are areas of specialty. Interdisciplinary research such as biometeorology and atmospheric chemistry is encouraged.

Environmental Geology: The earth's surface, its geometry and the nature of its materials, is an integral part of the environment and regulates many of its processes. Environmental geology deals with the problems that man encounters in his use of the earth. Some of these problems are so immense, so powerful, that they constitute some of the principal hazards to life—earthquakes, volcanism, landslides, and floods. However, others are responses of the earth to our utilization—erosion and siltation, land subsidence, foundation failures, and water table fluctuation. An understanding of the materials and processes of the earth's surface is mandatory if we are to predict a geological hazard and to plan so as to reduce its impact. Further, it allows us to design our water, building, transportation, and utility systems in accord with the geologic environment and so minimize deleterious effects.

The environmental geology option within the department is structured so as to give the undergraduate the fundamental background in geology necessary to the solution of problems in engineering, hydrology and hydrogeology, land use, and mineral extraction. At the graduate level more emphasis is placed on the mathematical, geophysical and geochemical aspects of environmental geology so as to produce those theoretical models required for conceptualization, understanding, prediction and management of earth surface phenomena.

Ecology: Ecology emphasizes the interrelationships of organisms and their environment. The basic ecological and environmental principles are the subject of the four undergraduate core courses. Undergraduate students follow a curriculum tailored to their particular interests and career aspirations. Students who plan to continue in ecology in a graduate program must combine basic and advanced courses in biology, physics, chemistry and mathematics with such departmental upper level courses as population ecology, aquatic and terrestrial ecology. On the other hand, those who plan to seek employment as professional ecologists upon graduation should choose to concentrate on departmental courses in applied hydrology, soil science, water chemistry, applied ecology, population ecology, and applied climatology in place of advanced courses in other departments. The graduate ecology program emphasizes the areas of faculty strength and ongoing research programs. Students are encouraged to take the systems ecology course and statistics and must participate in one or more advanced seminars covering such diverse topics as niche theory, decomposition processes, biogeochemical cycling of heavy metals, advanced systems analysis modeling, productivity analysis, and nutrient processing.

Hydrology: Modern society faces the formidable task of finding and maintaining adequate water resources if the continued existence of a high-quality environment in a technological society is to be assured. The solutions of water-resource problems are complex issues requiring scientific, engineering and social consideration which, coupled with their growing importance, indicates that there will continue to be a strong demand for water scientists and managers in the future. These scientists/managers will certainly require substantial specialized training in hydrology and water resources, but will also need a breadth of understanding in related areas. The hydrology option in the Department of Environmental Sciences provides a unique setting for such a program of education.

Students selecting the hydrology/water resources option will have a variety of career goals and the program is designed to be flexible enough to accommodate this variety. The hydrology core seeks to develop a strong foundation in the basic principles of physical hydrology and to generate an aptitude for applying these principles to "real-world" problems. Breadth of knowledge is attained through complementary offerings in soils, geology, meteorology/climatology, water chemistry, ecology and resource analysis. Work in mathematics and the basic sciences is encouraged, especially for those seeking to become professional scientists.

The department also offers a hydrology option at the graduate level. Graduate training demands a proficiency in the theoretical constructs underlying explanation in physical hydrology as well as in the advanced techniques necessary to understand and quantitatively describe hydrologic and water resource systems. This approach provides the background necessary for completing thesis or dissertation research and with an increased depth of knowledge in all aspects of water science. Graduate programs are tailored to individual needs.

Integrated Studies

Any combination of a courses from the preceding areas may be organized to support a graduate student's particular research interests. One such possibility is in environmental chemistry. The department emphasizes atmospheric chemistry and the geochemistry of natural waters. Both emphasize the integration of field, laboratory and theoretical methods in order to elucidate the chemical processes which occur in man's natural environment. This objective is realized by carefully designed field techniques, modern analytic instrumentation, and physicochemical modeling for the investigation of a wide range of natural waters, earth surface materials, and atmosphere/surface exchange. Excellent opportunities are available for interdisciplinary research in ecology, meteorology, hydrology and geology.

Analytical facilities within the department include atomic absorption spectrophotometry, plasma-jet emission spectrometry, UV-visible spectrophotometry, autoanalyzer unit, and standard electrometric equipment for field and laboratory analyses. Through the Chemistry Department, neutron activation analysis, spark-source mass spectrometry, X-ray fluorescence and polarographic techniques are available.

Another focus of courses supports a specialty in natural resource analysis and management. Industrialization, urbanization, and the exploitation of natural resources have had a significant impact on the natural environment, and constitute the basic forces in the creation of man-made environments. With the increasing complexity of man-made environments and their interaction with natural environments, society needs administrators, planners and managers who understand the scientific principles behind these areas of interaction. The resource analysis option provides training in two basic sets of concepts and techniques used to manage the physical processes on which the department focuses. One set deals with economic and statistical concepts associated with evaluating benefits and costs of resource usage and identifying optimum levels of usage. The other deals with concepts and optimization procedures for physically achieving these usage levels. Either set may be applied to water, land, air or ecological resources.

Graduate training in resource management at the Masters level aims at providing students from various backgrounds thorough training in the management of specific resource systems. Doctoral students are to achieve an ability to advance theory and methods of resource evaluation.

Research

The department's interdisciplinary research activities are mostly organized on a team basis. The complexity of problems facing the environmental scientist demands cooperative investigations. Research programs are designed so that individual investigators can utilize their talents to solve segments of problems that may be combined to produce large-scale solutions or produce new basic understanding of environmental processes. Because of the mounting population pressures on the limited area and resources of the coastal region of the United States, much of the department's research effort has been concentrated there. This includes studies of coastal cities, estuaries, marshlands, and the inshore area of the continental shelf as well as terrestrial and fresh-water environments of the adjacent coastal plain and piedmont regions.

Investigations now in progress emphasize characterization of the dynamic processes occurring within the atmosphere, hydrosphere, and biosphere. These include both numerical and laboratory modeling and field experiments on a local and world-wide scale. Because man creates environmental stresses through profligate use of land and resources, the optimization of land use and resource allocation within the framework of the physical and biological system is the focus of several research projects.

The following research topics are typical of investigations now underway in the department:

Meteorology--

Meso- and synoptic-scale budgets in the atmosphere; the impact of a solar panel on the micro-environment; air pollution studies in coordination with the Virginia Highway Department;

Coastal wind energy and its power potential in Virginia;

Cloud populations and their interaction with the boundary layer;

Storm surge and coastal hazard evaluation;

Mesoscale atmospheric processes;

Evaluation and design of weather modification experiments;

Weather perturbations over the Southern Sahara during summer and their ecological effects.

Environmental Geology--

Arid land geomorphology; fluvial, eolian and slope processes;

Patterns of soil-plant atmosphere relationships;

Remote sensing of erosion-prone areas along barrier islands;

A process-oriented classification of coastal environments;

Area sources of sediment related to land use, reservoir siltation, estuarine sedimentation, sedimentary processes;

The chemical and mineralogical composition of coal ash and possible new uses of this abundant solid waste.

Ecology--

The sorption of pollutants by organic detritus in marshes, and food chain effects; origin, fate and composition of detritus;

Ecology of seagrass ecosystems; simulation modeling of ecological succession in natural and modified shore ecosystems;

Automated monitoring of aquatic community productivity and respiration; river basic nutrients and their effects on impoundments;

Study of vertebrate populations on barrier islands;

Population responses of wildlife species to power-line rights-of-way habitats;

The role of meiofauna and microorganisms in the energy budget of aquatic ecosystems.

Hydrology--

Water quality and hydrologic systems analysis;

The study of overwash and related storm-generated beach processes;

An optimal sampling strategy for water quality regulation;

Uncertainty in management decisions for pollution control;

A decision framework for evaluating the worth of routine water (quality) data.

Integrated Studies--

Evaluation of state, regional and national land use policies and projections; modeling urban spatial development;

Optimum population levels in relation to resources and environment;

Atmospheric chemistry of acid rainfall and its effect on lakes and reservoirs;

Sea-air-land exchange aerosols;

Background levels of SO_x as related to rural health problems;

Acid mine drainage as a control on heavy metal complexes in piedmont streams.

All of the above investigations involve interaction with faculty and graduate students with varying disciplinary backgrounds, and it is this opportunity for interdisciplinary work and thought that provides much of the challenge and excitement of research within the department.

Financial Support of Students

Three sources of financial support are available: scholarships and fellowships, teaching assistantships, and research assistantships. A student who files the standard University financial aid form will be considered for the first two on the basis of background and merit. Research assistantships are usually available through an individual faculty member's research project, and the principal investigators in one's area of interest should be contacted directly for information. At present, 75 percent of our graduate students receive financial support.

ETHICS, EDUCATION AND THE ENVIRONMENT: UNIVERSITY OF NOTRE DAME

by Kenneth E. Goodpaster*

Aldo Leopold once decried the fact that philosophy and religion had not yet discovered his "land ethic." That was in 1948. He would be delighted to learn, then, that an ecological conscience is alive and well in the Philosophy Department at the University of Notre Dame. Professor Goodpaster describes the interdisciplinary research that inspired the development of his course in Environmental Ethics--a systematic examination of decision-making on the part of top executives in the electric power industry. And he outlines in some detail the content and methodology of the course itself. (One of the required readings: Leopold's Sand County Almanac, naturally.) Professor Goodpaster also elucidates the pivotal role the professional philosopher can perform "if environmental studies are not to become the scene for a modern-day 'Tower of Babel'."

Background

Five years ago, through the initiative of Professors Neil Schilmoeller (Engineering) and Kenneth Sayre (Philosophy), an interdisciplinary research team was formed at Notre Dame (under the Center for the Study of Man in Contemporary Society) and funded by the National Science Foundation (RANN). The team's purpose was to examine systematically, with special attention to social and environmental values, the decision-making of top executives in the electric power industry. The team included philosophers, theologians, engineers, lawyers, sociologists, economists, and biologists. Most but not all were members of the Notre Dame faculty, teaching regularly and doing independent research in their respective departments.

The project commenced from a straightforward perception: that accelerating energy consumption has both desirable and undesirable consequences, and that key decision-makers often do not evaluate these consequences with the thoroughness that their importance warrants. We set out to understand how the acceleration of energy use is related to the pressures and values at work in decision-making at the power company level in our society's energy cycle. Our expectation was that there would be other levels in due course which

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would deserve equally intense study (e.g., the regulatory agencies, legislative and judicial bodies, industrial energy consumers, etc.). The results of the three-year study are available in Values in the Electric Power Industry, edited by K. M. Sayre (University of Notre Dame Press, 1977). Also, a second volume of specifically philosophical reflections by leading scholars in ethics will appear soon from the same press: Moral Philosophy and the 21st Century, edited by K. M. Sayre and K. E. Goodpaster.

Methodologically, the study broke new ground by the elaboration of what was called "ethical diagnostics"—essentially the application of descriptive ethics to corporate or organizational "persons" (as distinguished from the individual persons whose decisions contribute to the larger whole). Assessment is then based on the confirmed corporate ethical profile. Value tests and intensive interviews with twenty-five upper management decision-makers in Chicago's Commonwealth Edison, and similar interactions with Northern Indiana Public Service Company, provided the main empirical data. In addition, interviews with the staff of the Environmental Statement Project at Argonne National Laboratory helped to clarify our perceptions of the regulatory constraints on decision-making.

The picture which emerged was in some ways alarming. An expansionist attitude, with a limited horizon of social and environmental concern for future generations, appeared to dominate industry decision-making. This growth posture, with its attendant emphasis on nuclear power, derives support from legal, economic, and ethical assumptions which, under scrutiny, turn out to be weak. The "unthought thought" in a significant part of the decision structure is the substitution of energy conservation for accelerated production capacity.

The team concluded its study by elaborating implications and recommendations for change, citing the need for further inquiry into the regluatory dimension of power production. More on this last point later.

During the course of this research, the present writer developed an intense interest in the philosophical dimensions of our society's energy-consumption behavior--the relationship between ethical theory as traditionally understood and taught and the growing awareness of environmental or ecological values which seldom found a central place in that understanding and teaching. This interest led to the creation of a new undergraduate course offering at Notre Dame: Environmental Ethics. The course has been well-received by students from virtually every college in the university, and continues on a regular (yearly) basis. It is cross listed with a master's level program in Environics (Architecture) and present plans include a second, Ph.D. level, philosophy seminar with similar (though more advanced) content.

Course Content

Environmental Ethics (Philosophy 272) is conceived as an inquiry into (a) ethical issues raised by a new awareness of ecology and the environment, and (b) the extent to which these issues challenge our traditional ethical categories (right, wrong, good, bad, virtue, etc.). For example, if there is something called "the ecological point of view" on matters of acceptable conduct, how does it differ from and how does it resemble what has been called "the moral point of view"? The approach is part lecture, part discussion, guided by assigned readings and several appropriate films. Students are provided with regular study aids in the form of outlines, summaries, questions for discussion, and bibliography. Their work is evaluated on the basis of two examinations, a book review, a term paper, and class participation. Since the number of participants in the course in any given semester is typically limited to about seventy, a graduate assistant, though helpful, is not necessary.

The textual material around which lectures and discussions center has undergone evolution, and currently includes five books which are to be read by all and an additional two books from which one is chosen for review. The first of the five, W. K. Frankena's Ethics (second edition), provides an introductory background in normative and analytical ethical theory. Basic concepts such as value, obligation, and morality are explained and traditional principles such as egoism, utilitarianism and justice are formulated and assessed.

During the initial weeks of the course, students are asked to read either A Sand County Almanac, by Aldo Leopold or Small Is Beautiful by E. F. Schumacher (or both) and to do a critical review of one of them. Both books represent serious attempts at evoking ecological sensitivity in the reader. The former through the author's reflections on the wilderness that he loved and a "land ethic" that he hoped for; the latter through the author's creative challenge to conventional energy-intensive technology in the name of an economics "as if people mattered." The weeks following include material developed by the present writer on the nature of a "new" ethic, the possibilities of going "beyond humanism," and the concept of "ethical creativity." Concurrently, once each week for three weeks, students see and discuss films rented from Time-Life Multimedia and/or the U.S. Department of Commerce. Recent titles have included: "Energy Choices Ahead," "The Other Way," "The Plutonium Connection," and "The Nuclear Dilemma." Questions for critically evaluating the films are distributed to guide discussion. The thrust of the films is direct: through vivid portrayals of facts about such matters as accelerating energy consumption, the technological options, nuclear fission power, they confront the student with the size and scope of our society's predicament as well as the importance of values in dealing with that predicament.

At this point, material based on the research project described earlier is introduced as a kind of case study in environmentally significant decision-making: the electric power industry. Students are encouraged both to relate corporate values to traditional ethical positions and to explore the possibilities for a "new" corporate ethic, an environmental ethic, in the light of the constraints which are faced by executives in the industry.

After a midterm break, the course focuses on each of the four remaining books: The Closing Circle, by Barry Commoner (biologist); Man's Responsibility for Nature, by John Passmore (philosopher); Should Trees Have Standing? by Christopher Stone (lawyer); and An Inquiry into the Human Prospect, by Robert Heilbroner (economist). The choice of texts is deliberately interdisciplinary, though discussion tends to concentrate on the philosophical or ethical implications of each. Questions to guide reading and discussion are distributed before each book is taken up in class. Some of the topics treated in connection with each of the authors mentioned are:

Commoner: The Laws of Ecology
The "Technological Flaw"

Passmore: Pollution and Population
Conservation and Preservation

Stone: Legal Rights for Natural Objects?
Moral Rights for Natural Objects?

Heilbroner: Environmental Challenges to the Human Prospect
Our Capacities to Respond to the Challenges

Students' term papers, completed near the end of the course, deal with topics chosen by them from a list of issues provided about midway through the course. Some examples from the list:

— To what extent, if any, does the notion of "obligations to future generations" play havoc with traditional accounts of justice?

— Does the notion of "obligations to non-human beings" make any sense? Do we have such obligations? Consider the pros and cons of this issue.

The students are encouraged to work up outlines for their papers and to discuss these individually with the teacher in advance of the final draft, a practice which helps to avoid false starts and which usually enhances critical thinking. The course ends with a student evaluation (both formal and informal) and a final examination on the material covered since the midterm examination.

In sum, the course aims at factual awareness, an appreciation of the inevitable value trade-offs involved in responding to the challenges posed by environmental problems, and the formation of a critical (and creative) ethical perspective from which to address those trade-offs.

Further Developments

Measuring the success of such an educational venture, or for that matter, the research which inspired it, is difficult. One would be naive to look for dramatic social or institutional changes. A more modest hope might be the fostering of new and informed sensitivities on the part of both students and the decision-makers whose places they will eventually inherit. Encouraging signs can be read in developments like the following:

— recent student-initiated seminars at Notre Dame on environmental education, aimed at teachers in the South Bend area schools;

— new attention to environmental problems in other university courses, including chemistry, biology, and law;

- recent interaction between the Department of Philosophy and the College of Business Administration at Notre Dame, aimed at a more effective integration of management science with ethics;

- recent and planned conferences on such themes as "Business, Energy, and Ethics";

- a new two-year grant from the National Science Foundation for the interdisciplinary team discussed earlier: to study decision-making in agencies regulating the electric power industry. This project, now underway, involves an intensive empirical survey of the Illinois Commerce Commission, a regulatory agency whose importance for power industry decisions in its state is considerable. The hope is to be able to trace the influence of such an agency's "ethic" on the pattern of both corporate and consumer behavior.

These and other developments suggest that an environmental awareness is growing rapidly among students, educators and researchers in every part of the university community.

In conclusion, a few brief remarks are in order about the role of philosophy in this broad context of environmental research and education. It becomes apparent early on in one's involvement with questions of ecological responsibility that the subject is intrinsically interdisciplinary in character. No one branch of inquiry commands resources sufficient to deal with the complexity and connectedness of the scientific, technological, economic, political, administrative, and moral dimensions of the issues raised in these pages. Nevertheless, it is obvious that the task of integration--or perhaps more accurately, facilitation--needs to be performed if environmental studies are not to become the scene for a modern-day "Tower of Babel."

It is this writer's experience that philosophy, despite a 20th century preoccupation with epistemological topics often far-removed from the concerns of social policy, is a discipline historically suited for contribution to this task. For one thing, philosophy, more than most other disciplines, exhibits a self-conscious concern for the distinction between empirical fact and our evaluative response to empirical fact (without relegating the latter to the realm of uncritical preference). Furthermore, in the course of its traditional endeavor to model man's place in nature, philosophy has had to build bridges to virtually every art and science. Thus the challenges of interdisciplinary communication, though formidable, are at least not novel to most philosophers. Finally, and perhaps most importantly, the awareness of ignorance and a consequent search for wisdom in dialogue are a legacy from philosophy's Socratic origins which in our contemporary context we would be ill-advised to ignore. One hopes that the philosophers among us--and within each of us--will rise to the task.

ECO EDUCATION PROGRAM AT SAN FRANCISCO STATE UNIVERSITY

by William M. Hammerman*

Environmental studies at San Francisco State University are representative of those environmental education programs that have grown out of yesterday's conservation education or outdoor education programs. At SFSU, as a component of the School of Education there, the program understandably comprises courses, seminars, workshops, and field experiences for pre-service and in-service teachers, although the program can also be made to serve park interpreters, outdoor recreation specialists, and environmental guides. Emphasis is as much on the "how" of teaching techniques as on the "what" of content, stressing interdisciplinary, process-oriented approaches and the use of community resources. Both bachelor's- and master's-level work is available. A recent survey indicated local California school administrators rank environmental education only 43rd in priority on a list of 50 educational topics. But programs like ECO-Education keep trying to make a dent.

Introduction

The challenge of developing and maintaining an "environment fit for life and fit for living" is one of many such problems that 20th Century man will continue to cope with as he enters the next century. A dimension of this global issue, of primary concern to the educational sector, is that teachers and educators of the 1970's and 80's must face at least two basic questions:

1. Do our schools currently have curricula planned that will help prepare today's first-graders to become "environmentally literate" citizens in their post-secondary school world?

2. Are there sufficient numbers of teachers and resource persons, presently in the schools, who are qualified to teach environmental education programs in self-contained classrooms or as separate subject-matter courses or units of study?

Although environmental, conservation and outdoor education programs have been part of some California schools for the past 30 years, it can still be stated that few school districts have developed a complete K-12 scope and sequence curriculum related to environmental education. Many school

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children might experience one week at a Resident Outdoor School or a unit of study in one high school grade; but few, if any, are exposed to a planned K-12 environmental studies curriculum. A recent survey by the California Department of Education covering all school districts in the state indicates that of the local district environmental education policy statements submitted, less than 10 percent outline a program which is interdisciplinary, process-oriented or uses community resources. In addition, California school administrators ranked environmental education 43rd in priority among a list of 50 educational programs.

Purpose

Recognizing the above needs, the Interdisciplinary Studies in Education Department of the School of Education at San Francisco State University has developed an environmental education program that provides courses, seminars, workshops, and field experiences for pre-service teachers, in-service classroom teachers, environmental education specialists, park interpreters, outdoor recreation specialists, outdoor education "trail" teachers, and volunteer environmental guides.

Although the audience for this program is varied and broad, its major thrust is toward people who will be performing a "teaching" or "guiding" role with "learners" who will range in age from early childhood to senior citizens. The basic rationale underlying the program is that "teachers" should be competent in utilizing many different teaching-learning situations and settings, effectively and efficiently, in achieving the stated goals and objectives of the environmental education curriculum. The program content is based upon the premise that a major goal of education "is the recognition by man of his interdependence with his environment and with life everywhere, and the development of a culture which maintains that relationship through policies and practices necessary to secure the future of an environment fit for life and fit for living."

The environmental education course sequence at SFSU is designed to prepare teachers and leaders that will not only know what to do, and how to do it; but why they do it in a particular manner or style. In addition, they must be competent in finding out whether or not the experiences developed did, indeed, accomplish the intended purposes.

Program Design

Although two courses were initially developed in 1960 and pertained primarily to the field of outdoor education, the current program has been expanded and can accommodate individuals who are interested in environmental education, camping education and/or outdoor education; hence the use of the term, "ECO Education."

The following questions were used as the basis for developing and designing the various program offerings:

a. What is the meaning of environmental education?

b. What are the goals and objectives of environmental education?

c. How do you relate environmental education to the school curriculum: reading, math, science, social studies, art, music, language arts?

d. What teaching strategies can be used in environmental education?

e. How do you develop environmental education programs and experiences?

f. How do you evaluate environmental education experiences?

The list of current course offerings consists of:

Educ. 626 - ECO Education in the School Curriculum
Educ. 627 - ECO Education Field Course
Educ. 726 - Organization and Administration of ECO Education Programs
Educ. 727 - Seminar in ECO Education
Educ. 728 - Field Work in ECO Education
Educ. 729 - Internship Seminar in ECO Education

These courses are offered on campus and are open to undergraduate students as electives (600 courses, only) and to graduate students working toward the M.A. in Education Degree: Concentration in a Special Interest Area (ECO Education). The requirements for such a degree option are:

A. Must include a minimum of three courses from those courses offered in the following areas (9 semester hours):

1. Human Relations in Education
2. Human Development and Learning
3. Research and Evaluation
4. Foundations of Education
5. Curriculum and Methods
6. Guidance and Counseling

B. Electives: may include courses offered by departments outside the School of Education depending upon interest; e.g., Science, Geography, Recreation, Urban Studies, Anthropology (9 semester hours).

C. Related Field or area of concentration: ECO Education (12 semester hours).

D. Terminal Project: field study or thesis (3 semester hours)

One unique feature of this M.A. in Education program is that a teaching credential is not a prerequisite for admission. Consequently, a typical class might consist of students who graduated or are majoring in the following areas: education (50%); recreation (25%); science (25%). Since many of the non-education students hope to work with school-age children in a non-school setting, they do elect to go on to earn teaching credentials over the above their B.A. and M.A. degrees to establish their credibility as "teachers" with the education sector. (For example, consider a recreation major who serves as a county park interpreter for school groups.)

Additional courses, however, are only available through the Division of Continuing Education. For example:

Educ. 625 - Leadership Development Workshop: ECO Education
Educ. 628 - Directed Experiences in ECO Education
Educ. 629 - Workshop in ECO Education
Educ. 689 - Children's Interpretation

These courses are offered during the regular Fall and Spring Semesters as extension courses and/or during summer sessions as a part of the Field Experience Program in ECO Education. These events are conducted both in the State of California and out-of-state. The instructors and resource people involved in the seminars, workshops, and conferences represent a variety of perspectives on environmental issues: governmental, industrial, business, labor and community. Some examples of recent environmental education workshops for teachers in the San Francisco Bay Area are:

a. Natural Resources and Their Impact Upon Urban Life;
b. Pollution and Its Impact Upon Urban Life;
c. Urban Problems and Their Impact Upon People;
d. Energy Sources for the Urban Dweller;
e. Teaching Techniques for Environmental, Conservation and Outdoor Education;
f. Computer-Based Resource Units in Environmental Education.

The basic purpose of the "out-of-state" Field Experience Program is to offer ECO education staff members and National Park Service personnel the opportunity to earn academic units for professional field experiences in environmental education. These experiences are conducted or supervised by certified professionals in selected centers across the nation.

From time to time, special-topic workshops are sponsored on weekends that address themselves to specific themes. Recent titles have been:

a. Adventures in Learning: Using the Redwood Forest as a Laboratory for Learning;
b. Workshop in Alternative Environmental/Experiential/Education;
c. Workshop: Man's Need for Timber vs. Man's Need for Forests;
d. Seminar: Evaluation of ECO Education Programs;
e. Workshop: How to Use Bay Area Resources for Teaching Environmental Education to Urban Children.

Funding

The on-campus elements of this program are available to any student who has been admitted to the institution. There is a difference in the schedule of fees between resident and non-resident students. Tuition is not charged to legal residents of California. They do pay for various student services and activities, however. Tuition fees are paid by students who are not legal residents of California.

Programs offered through the Division of Continuing Education (Extension and Summer Sessions courses) must be self-supporting; consequently, an official registration fee is established each year. Occasionally an outside group or grant will provide partial scholarships for workshop participants. In these situations, a lower fee can then be established for the event.

Future Developments

At the present time, two curriculum proposals have been developed for students at the undergraduate level. One program is campus-wide, and the other is just for teacher credential candidates.

1. Liberal Studies Major. At San Francisco State University, it is possible for undergraduate students to identify a theme that ties together the depth component of an interdisciplinary program where courses are selected from many different departments. This theme is the alternative for the "discipline" which provides the depth component of most other majors. Currently, the student's theme is his own, and is tailored to his interests, experiences and needs.

It has been proposed that "Environmental Studies" be created as a "pre-identified" theme or area of concentration within the Liberal Studies Major framework. In addition, appropriate sub-themes would be developed as options within the broad spectrum of the Environmental Studies major. For example:

Sub-Theme	Primary School/Department
a. Environmental Sciences	School of Science/Department of Ecology and Systematic Biology
b. Human Environmental Studies	School of Behavioral & Social Sciences/Department of Geography
c. Environmental Communications	School of Creative Arts & School of Humanities
d. Environmental Education and Interpretation	School of Education and Recreation Department.

The majority of the courses that could make up the major theme and sub-themes already exist in the various departments of the university.

What is lacking is the visibility of these options as an organized program of study. One of the advantages of this proposal is that it permits the undergraduate student to explore the many dimensions of a rapidly growing field, along with the opportunity to concentrate on a sub-theme. Students who complete such a program could continue to specialize by enrolling in a graduate level program of their choice; e.g., urban environmental planning.

2. Elementary Education Credential: The California credential program for teachers in a multiple-subject matter, self-contained classroom program consists of three main areas:

I. Foundation Courses: Human development & learning; generic curriculum.

II. Curriculum & Instruction Courses; Reading, language arts, mathematics and social studies.

III. Practicum in a School: Student teaching and seminar.

It has been proposed that an ECO Education resource teacher be assigned released time in order to meet with every elementary education class each semester in order to help prepare the pre-service teacher to learn the what, how, why, and when of environmental eudcation. Although there is some overlapping, the emphasis at each level will be:

I. What is environmental education?
What are the learning goals of environmental education?
Where can environmental education experiences take place?

II. How does environmental education relate to the school curriculum?
What teaching techniques are appropriate for environmental education?

III. How do you design environmental education activities?
How do you evaluate the effectiveness of environmental education experiences?

The goal is to prepare classroom teachers, at the elementary school level, who will be capable of developing environmental education programs and experiences that will be interdisciplinary, process-oriented and utilize local community resources.

Evaluation

To date, the only measures of performance are descriptive; that is, where have some of the graduates of the various program components "ended up" regarding environmental education? A few case studies will illustrate these areas of performance:

a. Ken was an elementary education teacher when he entered the M.A. program. He is currently the Coordinator of Environmental Education for his school district. His program, K-6, includes 13 different kinds of environmental experiences. These activities take place both indoors and out-of-doors, and all the way from the school ground to a distant resident outdoor center.

b. Phyllis worked for the Environmental Protection Agency as a secretary. She is now employed by a non-profit, tax-exempt educational organization that specializes in resident outdoor education programs with an environmental studies emphasis. She is also working toward a secondary level credential.

c. Joe was a sixth grade teacher when he enrolled in the SFSU ECO Education program. He integrates environmental education experiences into his regular classroom lessons and coordinates special programs in the out-of-doors for his district during the summer.

d. Tom is continuing to offer environmental and outdoor education programs as part of his responsibilities as Curator of Physical Science at a local Junior Museum. These programs vary from activities on the museum's ground to three-day trips to unique natural areas. Tom also serves as a resource teacher to resident outdoor school programs conducted by individual schools in the local district.

e. Luke, a recreation specialist, has directed Youth Conservation Corps programs. A major component of this program includes not only work experiences related to the natural environment, but environmental studies and outdoor recreation activities as well.

f. Dave, a biology major, and several of his fellow graduates were unable to find full-time professional positions. Consequently, they formed a tax-exempt, educational organization, wrote grant proposals and received funding for leading day field trip experiences for the local schools. In addition to developing their own environmental education curriculum and field trip guides, they have produced bi-lingual and cross-cultural resource materials.

Several other pre-service teachers, who spent part of their student teaching experience in a resident outdoor school, are now working full-time as "naturalists" or "field teachers." The large majority of their teaching pertains to environmental topics and issues.

The fact that former students can perform satisfactorily in the execution of their various environmental education responsibilities is the only feedback data that have been obtained.

This narrative represents the status of the SFSU environmental education program for 1978. It is primarily an interdepartmental program within the School of Education. Hopefully, the next decade will see greater integration with programs and courses offered through other units of the university.

ENVIRONMENTAL INITIATIVE AND CHANGE IN PATTERNS OF INSTRUCTION AND RESEARCH AT THE UNIVERSITY OF GEORGIA

by Mary A. Hepburn and Robert N. Saveland*

It was common in the 1970s for environmental education emphases to find fertile soil in the science education departments of schools of education. It was not common for professors of social studies education to identify with environmental issues. One exception was at the University of Georgia, where the authors assumed roles of state and national leadership in developing curricular materials and instructional techniques for helping secondary school teachers relate local environmental issues to social studies principles. Two initial experimental courses have led to heightened communications among faculty, students, and citizenry—a not uncommon spin-off from environmental studies programs.

Since April 1970 when the first environmental teach-ins were held on college campuses across the country, the Department of Social Science Education at the University of Georgia has undergone a number of changes as a result of responses to the "environmental crisis." The changes which arose from concerns over environmental educational needs came slowly, but gradually they have had an impact on the curriculum, the patterns of professional development, research activities, the lines of cooperation among education professionals and the university's service relationship with a large school district.

In the spring of 1970, both authors were teaching undergraduate courses on instructional methods in social science education. On April 22, "Earth Day," each focused class attention on current environmental issues and the importance of their inclusion in the social studies curriculum. One of the authors, Robert Saveland, is trained in geography and education. The other, Mary Hepburn, is trained in political science

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and education. Each became interested in environmental questions generated by the perspective of a particular discipline (for example, geographic perspectives on man-land relationships, political perspectives on environmental public policy decisions). Both professors, however, perceived the importance of multi-disciplinary education for environmental awareness and choice-making. Likewise, both professors sought to make environmental education a component of teacher education and an integrated part of the curriculum of the schools.

The following paragraphs trace the ways in which the environmental interests of two faculty members in the department generated professional activities which contributed to formal and informal program changes in the department and the college. These were not the exclusive environmental education actors or activities in the department or college by any count. Presented here are only two cases in point.

An Experiment Reveals a Need

The first environmental action in the Department of Social Science Education came in the academic year following "Earth Day." The department agreed to be one of the six field-test sites for a newly developed interdisciplinary college course, The Quality of Life in America. The course was conceptualized and materials were prepared by The Quality of Life in America Project based at the University of Colorado and funded by the United States Office of Education.[1] The project's interdisciplinary development team was made up of professors from history and the social sciences from colleges and universities around the country.

At the University of Georgia, The Quality of Life course was offered to both pre-service and graduate secondary social studies teachers. Professor Hepburn taught the course, and subsequently served on the national panel which in 1971 evaluated its content and approach to provide guidelines for revision. The course was designed to provide teachers with environmental information, viewpoints and analytical approaches which would be applicable in the classroom. The response of student teachers and experienced teachers was enthusiastic. On tests they showed gains in information, issue awareness, and willingness to integrate environmental studies into their classes. However, when they attempted to translate their learning into teaching behavior, they soon expressed frustration with the lack of appropriate instructional materials and supporting time allocation in their schools.

Throughout the next three years, in presentations and articles aimed at state and national professional social studies groups, Professor Hepburn actively promoted environmental instruction and interdisciplinary environmental curriculum materials for grades 7-12. A proponent of cumulative environmental education throughout the secondary grades, Professor Hepburn joined other educators in encouraging cross-departmental cooperation to develop school programs grounded in scientific knowledge and method and focusing on local and national environmental issues.[2]

Movement Toward Change

Meetings with members of the Science Education Department of the University of Georgia in 1973 generated a plan by Professor Hepburn and Science Education Professor Ronald Simpson to hold a seminar with graduate students of both departments (most of whom were experienced teachers) to discuss the possibilities for developing a joint science-social studies environmental curriculum for secondary schools. These meetings turned out to be productive brain-storming sessions which ultimately produced an experimental rationale.[3]

In the fall of 1974 a proposal to combine efforts by the social science and science education departments to develop materials and test a model for implementing environmental studies in the secondary grades was drawn up for submission to the United States Office of Education to seek funding under the Environmental Education Act. The proposal received favorable review and was funded for the fiscal year, 1975-76. Thus, the curriculum project, Environmental Education for the Secondary Schools (EESS) was launched.

The main purpose of the project was to develop coordinated modular social studies and science curriculum for ninth and tenth grade students. The materials were designed to focus on issues of specific concern to the local community which are also of universal environmental significance. The cooperating school system, Gwinnett County School District, a large system in the suburban metro-Atlanta area, was and still is in one of the fastest growing counties in Georgia. Coordinated instruction in social studies and science was aimed at producing skills in obtaining background knowledge, applying this knowledge in analysis of actual community problems and feasible alternative solutions, and then deciding on channels and methods of individual citizen action.[4] In addition to producing positive student results, the project received high evaluations from teachers, administrators and community leaders associated with it.

A major by-product of the EESS project is an effective service alliance between university education professionals and the school and county community. University educators became directly involved in the actual environmental concerns of the school community: 1) through close work with teachers, students, and supervisors in the curriculum writing and testing phases, 2) through first-hand experiences and observation of the land use, population, pollution and energy problems of the county, and 3) through interviews with leaders of various interest groups in the county which revealed the broad range of viewpoints on the issues. Professors and graduate students of both the social science and science education departments of the College of Education were drawn from the "ivory towers" of the campus to doing applied research and development directly where it is needed. Currently, the school system prints and provides the environmental educational materials for several of its high schools. Professors from both university departments continue advisory work in the county, teach courses there and continue to do research there.

An additional benefit to higher education from the EESS project was the initiation of both formal and informal ties between social science education and science education faculty and graduate students. Members of the two departments worked as a team, researching, writing and testing the curriculum materials. The completion of the curriculum project's objectives in 1976 did not terminate the interdepartmental cooperation in the university. Project Director, Professor Mary Hepburn, and the Science Education Coordinator, Professor Jack Shrum, among others, continue the cooperative ventures in studies of student environmental attitudes. Joint environmental educational research by the social science and science faculty appears to be a long-term result.

Learning in the Field

In the early 1970's Professor Saveland who as a geographer was highly conscious of the value of field education, sought permission to design and offer an off-campus environmental course in which experienced teachers would study first-hand the environmental problems of a specific area. Departmental permission was given to offer an off-campus section of the graduate course, "Special Problems in Social Science Education: Environmental Education."

The environmental problems of the Savannah, Georgia area were selected as the topic of study, and teachers from that area began a quarter of field experiential learning. Included in their field experiences were a visit to one of the largest paper mills in the world, a tour of a shrimp processing plant and a yacht trip along the polluted Savannah River provided by the C & S Bank and the Army Corps of Engineers. (It should be noted that the Savannah River has been greatly improved since 1970. New treatment facilities at the paper mill, construction of a new city sewage plant and the eventual compliance of American Cyanamid Company with state water-quality standards have resulted in much cleaner waters). Resource persons who came to address the class included a metro forester, a member of "Nader's Raiders," and a real estate developer from Hilton Head.

This unusual type of direct field learning on issues of both local and national concern was evaluated as highly informative and useful by the area teachers who were involved in it.

The following year Professor Saveland expanded the field study program of the course and adopted a new format. It became a weekend in-service course open to teachers around the state. The weekend meetings were held in different areas of Georgia including the North Georgia mountains, Coastal Plain, Piedmont region, the Atlanta Urban Area and on the campus of the university.

Teachers who signed up for the course drove to a pre-arranged meeting site on Friday afternoons. Meals and overnight accommodations were provided at state university facilities where possible. Resource persons came to speak about environmental problems of each specific area on Friday evenings, and related sites were visited on Saturday's field-study tour. For instance, on the Piedmont region weekend, the open-pit kaolin mines near Milledgeville were visited, and students were able to observe first-hand the efforts of the mining companies to reclaim and revegetate the land to comply with state laws.

An energy theme began to emerge in the course as visits were made to the state's first hydroelectric power plant in Tallulah Gorge, a coal burning generating plant on the shores of Lake Sinclair and a new nuclear power plant in Baxley, Georgia. This led Professor Saveland to propose to Georgia Power Company that it fund travel scholarships so that more teachers could participate in the course. In 1974 the company granted fifteen scholarships of $150 each to teachers enrolled in this course. Grants have been given each year since.

In the summer of 1972 the paper work was initiated to give the course permanence in the department's teacher education curriculum and a place in the graduate catalog. The process of obtaining new course approval at a major university is complex and lengthy, requiring passage through various committees and the approval of different groups with vested interests. The course, "Social Science Education and Environmental Problems," was officially approved in the summer of 1974.

Beginning in the spring of 1976 the course was offered as a regular on-campus course with the enrollment drawn from various departments so that the students represented a variety of disciplines. Since the class continued to meet on weekends, it could also be attended by in-service teachers. Another significant change was made this year. Rather than using private automobiles and meeting at pre-arranged places, university vans were provided with field trips starting and ending at the campus. The drivers were members of the class and the instructor was able to more effectively use travel time for instruction. In addition, the vans promoted a kind of camaraderie among the students.

The following outline shows the content of the course. However, it reveals only the "bare bones" of what is learned. Studies are continually amazed at the fund of information which the environmental practitioners who serve as resource persons have at their fingertips. And frequently the school teachers are exposed to points of view which they had not previously considered.

1. Environmental Perception
    a. ethnocentric nature
    b. cultural biases
    c. problems of scale
    d. urban space
    e. ecosystems

2. Sequent Occupance
    a. changing resource utilization
    b. settlement patterns
    c. concommittant transportation development
    d. factors of crowding and increased pressure on land

3. Problems of the Piedmont
    a. erosion and sedimentation
    b. effects of impoundment in hydropower development
    c. pines, poultry, pecans, peaches, and pesticides

4. Problems of the Mountains
    a. National Forests and clearcutting
    b. pressure on recreational facilities
    c. second home development
    d. road building

5. Problems of the Coast
    a. protection of swamps and marshes
    b. olfactory pollution and paper mills
    c. aquifer and salt incursion into fresh water supplies
    d. port development and possible offshore oil

6. Problems of Metropolitan Atlanta
    a. transportation
        (1) Marta
        (2) Alternative Airports
        (3) Congestion
    b. housing, suburban sprawl, and zoning
    c. solid waste disposal
    d. Atlanta 2000

7. New Directions
    a. The New Town movement
    b. recycling
    c. changing values and population trends
    d. attention to the aesthetic environment

8. Curriculum Applications
    a. case studies and examples of new approaches
    b. the essential features of environmental education
        (1) transdisciplinary
        (2) involvement in community
        (3) an environmental ethic
    c. synthesis and evaluation

Summary

Reflecting over the past eight years, the authors find that environmental concerns have clearly had an impact on the professional research, instructional activities and the formal courses offered in our department and college. Environmental education for teachers has gradually been accepted and made available on an elective basis—especially at the graduate level. The gains are notable, but neither author finds them satisfactory. For example, the course described above reaches 1/1000 of the total student body in the university. Environmental education is still not considered by many social studies educators to be a necessary part of the content and methods of training teachers.

Perhaps this neglect is attributable to the interdisciplinary nature of environmental studies. Social studies teachers, particularly those teaching secondary grades, usually take their academic courses in specific disciplines of the social sciences. Hence, it is often left to the professional education program to provide intellectual and practical opportunities for teachers to apply multi-disciplinary approaches to environmental issues.

From our particular vantage point on higher education, we see that environmental involvement has come a long way since 1970, but given the magnitude of the need for environmental understanding in our society, we still have a long way to go.

NOTES

1. The Quality of Life in America, an interdisciplinary, teacher-education course development project funded by the U.S. Office of Education, directed by A. David Hill, University of Colorado. (The course textbook was published in 1973 as *The Quality of Life in America: Pollution, Poverty, Power and Fear* by Holt, Rinehart and Winston).

2. Mary A. Hepburn, "Media for Teaching About the Environment," *Social Education*, Vol. 35 (January, 1971) 93-100; "Environmental Socialization — New Responsibility in the Social Studies," *The Social Science Record*, Vol. 9 (Fall, 1971) 8-13; "Environmental Socialization in the Social Studies," *The High School Journal*, Vol. 56 (April, 1973) 305-311; "Providing an Analytical Framework for Environmental Social Studies," *Journal of Environmental Education* (Summer, 1974), 25-27.

3. See Mary A. Hepburn and Ronald D. Simpson, "Can the Curriculum Save Us?" *The Social Studies*, Vol. 66, (March/April 1975) 65-69.

4. *Environmental Education for the Secondary Schools: Final Project Performance Report*, Grant No. G00-2500685, Project No. 522AH51215. Submitted to the U.S. Office of Education, November, 1976. See also "Environmental Education for Community Action," in *Current Issues in Environmental Education-II*, (Robert Marlett, ed.) The ERIC Center for Science, Mathematics, and Environmental Education. The Ohio State University, 1976.

DEPARTMENT OF NATURAL RESOURCES, BALL STATE UNIVERSITY

by Clyde W. Hibbs*

Far from representing a response to E-Day, Ball State's Natural Resources Program was conceived in 1965. Administratively its evolution is a textbook example: an ad hoc interdisciplinary committee to a "bootlegged" Institute to a bonafide Department. Programmatically its evolution is also typical; a single service course, an undergraduate minor option, an undergraduate major, an embryo master's, a wishbook Ed.D. Not so typical is the fact that virtually all funding has been state tax dollars —no big federal or foundation grants. Based in natural resource science and technology, focused in part on equipping teachers with an environmental literacy, NRP curricula reflect three interrelated thrusts: resource conservation, environmental protection, and environmental education, all featuring an emerging emphasis on energy issues. With bailing-wire and string, as it were, the author has constructed what is now an ambidextrous program befitting a teachers college become a university.

Program Purpose and Goals

The program in Natural Resources has as its ultimate objective the education of people to help meet the increasing demand for personnel educated in the environmental resources area. It is further dedicated to contributing to the general education of students throughout the university by offering appropriate courses in Natural Resources and related areas. Through research and extension activities it also strives to provide services and otherwise contribute toward establishing and/or maintaining a state of harmony between people and their environment.

The goals of the Department of Natural Resources are:

1. To awaken in students a pursuit of knowledge, an awareness of intellectual freedom, the will to exercise it, and the ability to do so effectively.

2. To participate in and actively support the program of general studies by making available relevant natural

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resources courses that contribute to environmental literacy and consciousness of Ball State students.

3. To administer and teach high quality curricula for undergraduate and graduate natural resource majors/minors that will enable graduates to contribute significantly to understanding and management of natural resources.

4. To develop strategies which will encourage and administratively support research and/or creative endeavors of departmental faculty and students.

5. To conduct appropriate applied and/or basic research that may be utilized by state and federal agencies, environmental organizations, and private citizens to make wise use of Indiana's natural resource wealth and, where possible, upgrade environmental quality.

6. To provide services, through natural resource courses and other campus or extension activities, that assist various Indiana citizens and citizen groups in furthering their understanding and management of natural resources, and help to solve resource and environmental problems.

7. To cooperate with other units within the academic community as an aid in furthering university-wide goals.

8. To make graduating students aware of the importance of continuing their education through participation in professional societies, workshops, conferences, and other learning experiences.

9. To develop strategies for survival in an environmentally endangered world, and to foster the kind of intellectual climate which will enable us to ask searching questions regarding our natural resources and their use.

10. To develop and administer environmental education/science education curricula for undergraduate and graduate students and to develop close working relationships with other institutions of higher education, Indiana Department of Public Instruction, and public school personnel for the mutual benefit of all concerned.

Target Audience

The Natural Resources Program is designed to:

1. Provide appropriate courses as an integral part of the Ball State general education program.

2. Provide appropriate educational experiences to enable graduates with a major in Natural Resources to become professionally employed in Natural Resources and related areas.

3. Provide service courses for students pursuing a variety of curricula.

4. Provide a teaching minor in environmental conservation to complement teaching majors in a number of disciplines.

5. Provide a graduate major in Natural Resources particularly for students with an undergraduate major in a specialized discipline.

6. Provide a cognate (minor) in Natural Resources for doctoral students.

7. Conduct in-service workshops and extension courses for teachers and school administrators.

8. Conduct or assist with seminars, conferences, and workshops for professional employees of resource agencies, personnel employed by local, regional, and state governments, and for conservation/environmental organization personnel.

Natural Resources Program in Historical Perspective

During the 1964-65 academic year a number of faculty members were identified who were interested in exploring the future role of Ball State in the area of Natural Resources. Meeting for the first time on February 15, 1965, this group included representatives of the Departments of Biology, Geography/Geology, the Director of the Program in Regional and Urban Planning, the Coordinator of Sciences and Mathematics, and the Dean of the College of Sciences and Humanities. This Natural Resources Curricula Planning Group (NRCPG) met frequently to explore the various opportunities for the university to make significant contributions in the area of environmental quality.

The NRCPG sought the guidance and counsel of a number of people from coast to coast through correspondence and personal visits to the Ball State campus. The Chairman of the NRCPG also visited a number of programs including the Natural Resources Institute at The Ohio State University and University of Maryland.

The two initial recommendations of this study group included the establishment of a departmental minor in Natural Resources and an administrative unit to serve as an academic home for this new program. Following these recommendations, the departmental minor in Natural Resources was implemented March 9, 1967. Students interested in this new program enrolled in the first course, NR 101 - Introduction to Natural Resources, during the winter term of the 1967-68 school year.

Realizing that the study of natural resources should be of total university concern, requiring new ideas, diverse skills, and integrated approaches, it was felt that curricula in this area should be interdisciplinary with input from many disciplines of the university. However, a number of courses were developed for the proposed new curricula in Natural Resources to provide a unifying philosophy and to ensure that curricula be an organism instead of an aggregation of courses.

The first curricular development (departmental minor) was designed to enhance a variety of majors at Ball State by providing students an opportunity to pursue interests in Natural Resources. The early favorable response to this new minor motivated the NRCPG to explore additional curricular opportunities at Ball State. Upon recommendation by this study group the following curricula were developed and implemented on the dates indicated.

Graduate Minor in Natural Resources - May 20, 1968

Departmental Major in Natural Resources - April 16, 1969

Graduate Major in Natural Resources - December 14, 1970

The undergraduate major was designed to provide pre-service training to people who would seek employment in the natural resources field and to complement companion majors. The graduate program in Natural Resources is designed to enhance the educational background of students having a variety of undergraduate majors. An important function is to provide a "broadening experience" for students entering the program with specialized undergraduate degrees. The program interfaces with a variety of disciplines. Graduate programs are individualized for each person with consideration given to the student's undergraduate academic background, professional experience, and future employment interests.

With a restructuring of the general studies program at Ball State, courses in Natural Resources became an integral part particularly of the Sciences and Mathematics component. This provided an opportunity for the Natural Resources Program to contribute significantly to the educational experience of students at Ball State.

Curricular improvement has and will continue to be a continuous process. Modifications have been made in various curricula including the addition of options or areas of specialty. Course descriptions have been revised and course outlines have been updated. A number of new courses to support curricular improvements have been added. Currently the department offers approximately 45 courses, all of which have been established within the past decade.

With the establishment of the departmental minor, the Chairman of the NRCPG also became Director of the Natural Resources Program. However, on May 28, 1970, the Ball State Board of Trustees approved the establishment of a Natural Resources Institute to administer the Natural Resources curricula with the Director of the Natural Resources Program as the Director of the new administrative unit. This Institute functioned within the framework of an interdisciplinary advisory committee (formerly known as the NRCPG), with responsibilities within these major areas—teaching, research, and extension services. This advisory committee included representation from the College of Architecture and Planning, Teachers College, School of Physical Education, Institute for Urban and Regional Studies, Office of Extended Services, and the Departments of Biology, Chemistry, Geography-Geology, Physiology-Health Science, Physics and Sociology.

From the beginning (first course, NR 101 - Introduction to Natural Resources, taught during winter term, 1967-68) the response of students to courses and curricula surpassed expectations. This interest and demand for multiple sections of classes and new courses made it necessary to employ additional faculty. However, those faculty working in Institutes at Ball State are required to hold rank in an academic department. With the employment of additional faculty some difficulty was experienced in finding an academic home for people working full time in Natural Resoruces. A person might be well qualified to work in the Natural Resources Institute but academic departments were sometimes not interested in granting academic rank because the prospective faculty member may not have suitable credentials for a particular department. With the Institute as the administrative unit for Natural Resources, faculty had no assurance of direct input into the governance and reward system of the University.

This situation contributed to the establishment of a Department of Natural Resources, effective in June, 1973. This was accomplished by transferring the academic component of the Institute to the newly established department and changing the name of the Institute to the Institute for Environmental Studies. Faculty members working in Natural Resources transferred from the Departments of Biology and Geography-Geology to the Department of Natural Resources.

Courses and Curricula Patterns

Early in the development of the Natural Resources Program the NRCPG decided that a number of courses should be developed specifically for the undergraduate and graduate minor and major. It was felt that these courses were necessary to give the curricula a unifying philosophy and integrated approach. Initially these new courses had an Interdepartmental (ID) prefix; however, this was later changed to NR because it was more descriptive. Frequently, a syllabus for a proposed new course was, and still is, forwarded to professionals employed in the field for review and suggestions. Soils courses were reviewed by Soil Conservation Service personnel, water courses were reviewed by personnel of the water and wastewater treatment plants, and the solid waste management course was reviewed by the manager of the Muncie Sanitary District. Many suggestions received were incorporated into such courses before final approval was requested for a proposed new course.

Initially some departmental chairpersons and faculty felt that the new courses should be located in existing departments and taught by faculty in the department where the course was located. If this approach had been followed, it is likely that the courses would have been taught as Biology, Geography, Geology courses or whatever discipline offered the course. Had this occurred teaching the new course might have been a peripheral interest of the faculty member teaching it with most of the instructor's time devoted to teaching traditional courses in the discipline. Also, it is likely that the person teaching the course might not have had an appropriate academic background and professional experience in the area related directly to the course. Fortunately, the new courses were developed and taught as natural resources courses by faculty who were employed because of their qualifications to teach them.

The curricula administered by the Department of Natural Resources include the following:

1. Undergraduate level

   a. Departmental Minor in Natural Resources

   b. Teaching Minor in Environmental Conservation

   c. Departmental Major in Natural Resources with the following areas of speciality:

      Option 1 - General Resource Management
      Option 2 - Resource Geography
      Option 3 - Fishery Resources
      Option 4 - Communications
      Option 5 - Water Quality
      Option 6 - Natural Resources Interpretation

2. Graduate level

   a. Minor in Natural Resources

   b. Major in Natural Resources

   c. Cognate in Natural Resources for doctoral students

Each of the undergraduate curricula includes a required core with students also having an opportunity to elect courses from a number of prescribed groups, commonly referred to as directed electives. Normally a student's program includes from one-third to one-half of courses taken from other departments of the University. This multi-disciplinary curriculum strengthens the student's professional preparation because those enrolled are exposed to faculty members from many disciplines.

The common core and option concept recognizes that there is a commonality of knowledge and experience that is desirable for all students majoring in Natural Resources while providing an opportunity to gain depth in an area through the completion of a speciality or option. This approach is designed to provide all students with a broad background in natural resources, emphasizing interrelationships and also enabling those enrolled to develop a special area of competency.

Facilities

Initially Natural Resources faculty offices were located in office space provided by the departments in which the individuals held academic rank. The lecture-discussion portion of classes were scheduled wherever and whenever rooms were available anywhere on campus. However, the soil resources and water resources classes were scheduled in a laboratory/ classroom provided by the Department of Geography/Geology. Later the Natural Resources program shared a suite of offices and a secretary with the Institute of Urban and Regional Studies.

Shortly after the establishment of a Department in June, 1973, the Natural Resources program was relocated in Lucina Hall, which had previously been used as a dormitory. The student rooms were used for faculty offices, the dining area was converted to classrooms, and the kitchen was modified and used as a laboratory until adequate facilities could be provided. However, it was necessary for some classes to continue to meet in a number of buildings across campus.

Additional space became available when the Services and Stores personnel moved into a new building and vacated West Quadrangle located near Christy Woods. This building was reassigned to the Departments of Journalism and Natural Resources. Both departments were given the opportunity to develop detailed plans for remodeling the building based on projected program needs, using an appropriation of approximately $1.5 million provided by the Indiana General Assembly. Following renovation the Department of Natural Resources moved into its new facilities in July, 1977. This modern facility, consisting of approximately 14,000 square feet, provides separate laboratory/classrooms for Air Resources, Environmental Education/Interpretation, Soil/Mineral Resources, Water Resources, and related prep rooms and central stockroom. Also included are two general purpose classrooms, field equipment storage area, seven faculty research laboratories, environmental education materials center, audio-visual room, student reading area, office for graduate students, office for graduate assistants, darkroom, research and development shop, room for computer terminal, and a conference room. The facility also provides office space for fifteen faculty members, a departmental office and space for supporting secretarial services.

Outdoor areas owned by the University and available for research and other educational uses include Christy Woods, Cooper Woods, and the Ball State Wildlife Preserve. Other facilities used for instructional purposes are local quarries, farms, forests, water and wastewater treatment plants, industries, sanitary landfill, Prairie Creek Reservoir, White River, and local parks.

Faculty

Department of Natural Resources faculty members are selected for their ability to fulfill departmental responsibilities with teaching competence being of paramount importance. Active research, writing, and extension work are integral to departmental activities. All regular faculty members have the doctorate degree, have an interest in and are competent in the general environmental area, and teaching NR 101 - Introduction to Natural Resources is normally a part of the teaching assignment. In addition each person has an area of specialization. All faculty are involved with local, state, or national environmental/conservation organizations through a variety of assignments and responsibilities. Many have been professionally employed by state or federal resource agencies in their respective resource fields. It is unlikely that any of the present Natural Resources faculty would be employed at Ball State University without the Natural Resources program, although all have strong educational backgrounds in a number of traditional disciplines.

Departmental Cooperation

Interdisciplinary activities are an important part of the Natural Resources program. On a number of occasions Natural Resources faculty have taught courses in the Biology and Geography-Geology Departments. Likewise members of those departments have taught courses offered by the Department of Natural Resources. Natural Resources faculty also serve on doctoral committees when the candidate elects a cognate in Natural Resources or as a "member at large". During the 1976 spring term a member of the Natural Resources faculty cooperated with a faculty member in the Department of Economics in teaching a new course in Environmental Economics that had been jointly developed by both departments. On one occasion a Natural Resources faculty member was "loaned" to the College of Architecture and Planning on a half-time basis for one quarter to teach a course in landscape engineering. The following term the same faculty member was loaned to the local Region Six Planning Commission on a one-third time basis to prepare an application for a 208 planning grant. On other occasions a faculty member has been employed by the University of Wisconsin during a portion of two summers.

The department also utilizes the services of resource people in the community and state to enhance the educational experiences provided students enrolled in Natural Resources classes. These include representatives of industry, local governmental units, Indiana Department of Natural Resources, Indiana State Board of Health, U.S. Soil Conservation Service, and the Cooperative Extension Service. Selected high school teachers have sometimes been employed to teach NR 101 when offered as an evening and Saturday class. On another occasion a faculty member from a nearby college was employed to teach the air resources course as an evening class.

In addition to teaching, departmental faculty are also involved in off-campus extension activities with one person normally assigned one-third time for this type of work. This includes working with school corporation personnel in developing environmental education curricula and outdoor laboratories and conducting workshops for in-service teachers. This person also works with local, regional and state governmental units and resource agencies. Faculty are also involved with a large number of conservation/environmental organizations as consultants, members of advisory councils and as officers. Students are also encouraged to become involved in these experiences. Assistance is also provided to other colleges and universities in establishing and improving environmental education programs.

Laboratory and Field Experiences

Providing practical or "hands on" experiences is an integral part of the educational program of students in Natural Resources courses at Ball State University. Most of the courses offered include a weekly two-hour laboratory and/or field experience. Some courses even include two- or three-day extended field experiences which provide students an opportunity to learn first-hand about environmental problems. Some courses, particularly for teachers, are taught in the community where the instructors are employed. Students are encouraged to get out where the action is by participating in practicum activities or internships ranging from one to twelve weeks under the supervision of a faculty member and/or professionals working in the conservation/environmental field. If planned in advance, it is possible for students to earn up to eight hours of credit by enrolling in NR 496/596-Practicum in Natural Resources. In some cases students may earn an additional four credits by enrolling in NR 497/597 - Special Studies in Natural Resources.

Students may participate in internships any time during the year; however, many are involved during the summer months. The types of internships are varied and include experiences provided by resource agencies such as the Soil Conservation Service, Forest Service, or Indiana Department of Natural Resources. Other students may work in nature centers, YCC programs, consulting firms or commercial shooting preserves.

Special environmental education programs are conducted during the summer months for both pre-service and in-service teachers. These include orientation sessions on the BSU campus followed by two consecutive weeks of traveling throughout Indiana, Ohio, and Michigan studying exemplary EE programs. This experience is concluded with follow-up and evaluation activities back on campus.

Student Enrollment

The response to the Natural Resources Program has been excellent when one considers that 30 students were enrolled in the single section of NR 101 during the winter term, 1967-68, as compared to approximately 642 students enrolled in 30 sections of 12 different courses during the autumn term, 1977. Much of the enrollment increase can be attributed to students enrolling in NR courses in fulfilling a portion of the University general studies requirements, which is one of the important goals of the program. Also, the number of students enrolled for the undergraduate minor has increased to approximately 100 with more than 200 currently enrolled for the major. The graduate enrollment continues to increase slowly with approximately twenty students enrolled for the Master's degree and a very limited number enrolled for a cognate in Natural Resources at the doctoral level.

An analysis of the total enrollment indicates that the NR 101 - Introduction to Natural Resources course attracts more students each term than all other courses combined. Approximately 50 different disciplines are enrolled in this course each term with the largest number listing natural resources as the major. The composition of the upper division courses is primarily natural resources majors. However, students majoring in Biology, Geography, Geology, and Landscape Architecture commonly elect these courses.

Student enrollments in each section of NR 101 are limited to a maximum of 32, with 24 being the maximum number enrolled in other courses offered by the department.

Funding

There was no funding provided for the initial planning for the Natural Resources program. The Chairman of the Natural Resources Curriculum Planning Group provided the leadership while carrying a full teaching load in the science department. There was also no reimbursement for this nor did any other faculty members have released time while serving in an advisory capacity.

With the establishment of an undergraduate minor in 1967-68 the Director of the Program was allocated one-ninth time to teach one course offered during the winter term. There was no time allocated or renumeration for advising students and providing leadership for continued development of the program. However, as the program expanded some time was allocated for administrative duties and for increased teaching responsibilities related to Natural Resources courses.

Funding for these responsibilities was provided entirely by the State of Indiana as an integral part of the Ball State University budget. Initially, this financial support was provided through the budget of the Dean, College of Sciences and Humanities. However, with the establishment of the Department of Natural Resources, effective June 1973, a separate budget was established for this new administrative unit.

The major portion of financial support has been for faculty starting with a one-ninth FTE during the 1967-68 school year. However, this has increased as the program has expanded until currently the Department has eight full-time faculty positions. Additional part-time faculty are employed on a temporary basis in an attempt to meet the demand from students for Natural Resources courses. Increased financial support has also been provided for the purchase of equipment, supplies, and for additional secretarial services.

Very limited financial support has been provided for the program from money contributed by a few individuals to the Ball State University Foundation. Except for a small National Science Foundation equipment matching grant, all other support has been provided through the regular Ball State University budget. Establishment of the Natural Resources program was not contingent upon external funding as has been true at some institutions of higher education.

Uniqueness of Program

Unlike environmental programs at some colleges and universities, Ball State's Natural Resources program was not a response to "Earth Day" because the initial planning began in February, 1965, and the first students enrolled in the new curricula during the winter term of 1967-68. This occurred because members of the Natural Resources Curriculum Planning Group were concerned about the quality of the environment and resolved to design an appropriate strategy which might contribute to the prevention of some environmental problems and help in solving existing ones. Because of this early planning, the program was not hastily structured and, hopefully, mistakes have been minimized.

The strategy used in designing the program provided an opportunity for many disciplines and other administrative units of the university to have input primarily through the NRCPG. This contributed to the present interdisciplinary curricula which has a balance of existing and new courses offered by other departments and the new NR courses developed for the various curricula administered by the Department of Natural Resources.

The Natural Resources curricula include three important interrelated components: 1) resource conservation, 2) environmental protection, and 3) environmental education. Recently, energy resources, which permeates all three components, has received greater emphasis. Environmental programs at other institutions often focus on one or possibly two areas and/or do not adequately consider both renewable and nonrenewable resources.

Employers of Ball State Natural Resources graduates have indicated that one of their strengths is the ability to work with people. This strength, sometimes referred to as "humaneering," is recognized by departmental faculty as being of paramount importance and is fostered accordingly.

Departmental Organization

The Department of Natural Resources is administratively located in the College of Sciences and Humanities at Ball State University. The four other colleges include: 1) College of Architecture and Planning, 2) College of Business, 3) College of Fine and Applied Arts, and 4) Teachers College.

The Chairman of the Department of Natural Resources is elected by the regular department faculty for a three-year term. This person is administratively responsible to the Dean, College of Sciences and Humanities. Other staff include a full-time secretary with additional secretarial services provided by student secretaries. Normally each full-time faculty member may have two hours of student secretarial help per day if needed.

The following committees provide an opportunity for faculty to have direct input into the operation of the department:

- Budget and Facilities
- Educational Resources
- Employment and Alumni Relations
- Graduate Programs
- Internship/Practicum
- Lecture/Seminar
- Promotions and Tenure
- Public Service/Public Relations
- Research
- Undergraduate Curriculum

The department has input into the university governance and reward system through representation in the University Senate and a variety of councils and committees.

Future Challenges

Having excellent physical facilities available now offers new opportunities and challenges for the Department of Natural Resources. Many of these have already been identified and included in the Department's five-year plan which was completed in November, 1976. High on the list is the need for continued improvement in the quality of instruction in all courses. With research laboratories available for the first time, both faculty and students need to become more actively involved in conducting meaningful research which, hopefully, will enable the department to resolve some pressing environmental problems. Related to this is the need and opportunity to expand the graduate component of the Natural Resources program.

Currently one faculty member is assigned one-third time to conduct extension activities. These activities include teaching off-campus courses, conducting workshops for teachers and resource agency personnel, assisting school corporations in developing and using outdoor laboratories and helping various governmental units, resource agencies and conservation/environmental organizations accomplish their objectives. This should be increased in order that the expertise of Natural Resources faculty will become more readily available to help people solve community resource problems.

The undergraduate major is currently being studied with the expectation of revising and updating it by including new courses, deleting less relevant ones, and the addition of new options such as outdoor recreation, soil science and environmental protection. This proposed revision should provide a curriculum that is more relevant to contemporary environmental challenges.

Plans for curricular development include an area of endorsement in environmental conservation for students majoring in elementary education and a supporting concentration in this area at the junior high/middle school level. These curricula have already been approved by Ball State University and will be implemented after being approved by the Indiana Teacher Training and Licensing Commission. A proposed new minor in energy resources management has recently been approved by the College of Sciences and Humanities and now awaits endorsement by the total university before being submitted to the Indiana Commission on Higher Education for approval.

New degree patterns currently being considered include the Associate Degree in Water and Wastewater Technology, a Master's degree in Environmental/Natural Resources Communications, and a Master of Arts in Education with a major in environmental education. Later the possibility of offering an Ed.D. or a D.A. degree may be explored.

The Department of Natural Resources has a unique opportunity to contribute significantly toward environmental improvement, especially in the area of environmental education/interpretation/communications through the proper integration of programs and expertise available in Teachers College, the Radio and TV Center, the Department of Journalism, and the many supporting discipliens at Ball State University.

TEACHER EDUCATION FOR THE ELEMENTARY SCHOOL WITH ENVIRONMENTAL EDUCATION AS THE COORDINATING THEME: THE OHIO STATE UNIVERSITY—NEWARK

by Lillabelle Holt*

The Newark Campus of The Ohio State University has made a campus-wide commitment to environmental studies as the unifying structural theme for the institution's professional undergraduate program in elementary teacher education. Supportive administrators, committed faculty, interested students, cooperative area school systems—these are the factors identified as crucial, not materials or facilities.

At the Newark Campus of The Ohio State University, elementary teacher education (for teaching careers in kindergarten through grade eight) has a coordinating theme of environmental education. The four-year program incorporates laboratory experiences with children in all education courses, and utilizes the alternative learning environments of the Licking County area to develop teacher competence and confidence in a variety of classrooms - an arboretum, cemetery, downtown square, urban residential block, nature trail, school cafeteria, horse farm, parking lot.

This program of teacher education was developed because of faculty interest and expertise, unusual local resources, and the need for elementary school teachers who can help children to appreciate and care for their environments. Faculty members formed a new program, titled "Laboratory Approach to Teacher Education" or L.A.T.E., in 1972-73; graduates are now in area schools and maintain contact with the university by serving as cooperating teachers for the undergraduate laboratory experiences. In this way, the program is strengthened and teachers are encouraged to implement environmental education into their total curriculum.

A three-year study, completed in September, 1972, focused on identification of teacher competencies for elementary school teachers who work with children in programs of resident outdoor education.[1] Directors of resident outdoor education programs, and classroom teachers, were asked

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to respond to 165 competencies "needed by classroom teachers." The directors identified only nine competencies as being competencies held by elementary school teachers; the teachers did not do much better; they identified 24, agreeing that there were 141 competencies missing in the qualifications of the elementary school teacher.

In response to the concerns of society and the conditions of man's environments, many schools are developing an environmental emphasis in the curriculum at all levels, kindergarten through grade twelve. Beginning teachers need preparation for working with boys and girls in the achievement of knowledge, attitudes, and skills for living successfully in the indoor and outdoor habitats of our world.

The L.A.T.E. program was designed to meet these two situations - the void in teacher education programs, and the need for environmental education teacher competence (and enthusiasm!). Previous attempts - to sandwich in among other coursework a workshop titled "Environmental Education" - was not sufficient. Faculty believed that a complete package was needed, one that cut across subject lines (who can place environmental education with science or social studies, or separate environmental education from math measurements or language art experiences?). A program was needed that was steadfast enough to allow the pre-service teacher to become comfortable, over time, with environmental education concepts, skills, and attitudes and related teaching techniques. Experiences were needed - successful and relevant ones - that would allow for the development of commitment to an ecological emphasis in the elementary school program for every boy and girl.

With the assistance and encouragement of area school teachers and administrators, naturalists, environmentalists, colleagues at the university - and utilizing the unique outdoor and indoor learning environments of the area - an alternative model for the undergraduate degree program in Early and Middle Childhood Education was submitted to the faculty and department administrators. The proposal was approved, and this L.A.T.E. model became the elementary teacher four-year program at the Newark Campus. Environmental education is the coordinating theme from the freshman laboratory experience in area elementary schools and social agencies (a two-quarter requirement) to a senior student-teaching quarter involving teacher responsibilities at a resident outdoor education center. This program is available to elementary education majors preparing for teaching careers in kindergarten through grade eight. The four-year program includes a variety of laboratory experiences with teachers and children - on a nature trail at the campus, in furnace rooms and cafeterias in elementary schools, on abandoned farms and busy central business districts, etc. Teaching techniques are "tried on" in a variety of learning environments in both indoor and outdoor settings, on and off campus, in the university and elementary school laboratories.

In the L.A.T.E. undergraduate preparation sequence, the required program has been expanded from the traditional junior-senior year format to a full four-year series of related experiences and coursework. Most experiences are required for all elementary education majors in this program; a few are available as options (ex. - summer employment in environmental education).

Environmental education reinforces and "pulls together" the Laboratory Approach to Teacher Education program in the following ways:

"Methods" Courses

Blocking of courses (for example, science and social studies) and field-based settings for learning allow faculty to:

a. set aside time for development of environmental education in the various subject areas, and

b. direct students in participation experiences in a variety of classroom and school settings where environmental education is a recognized emphasis in the school curriculum.

Faculty have made a commitment to environmental education as a structural theme in the elementary education program. Faculty and student experiences in related professional meetings and workshops are incorporated into the coursework; participation and leadership responsibilities are recognized and deemed important in the on-going evaluation of the L.A.T.E. program (How does this undergraduate program compare to a fifth year environmental education degree? What new teaching techniques in environmental education are not included in the L.A.T.E. program? Let's try these new ecological materials for learning about the urban environment!).

A further commitment - to teaching an environmental education emphasis in all curricular areas - is coordinated by teacher education faculty. Experiences in reading, language arts, social studies, mathematics, and science are provided by university faculty at OSU-Newark and by participants as they work with teachers and children in elementary school classrooms.

An added note - the field-based arrangement (the professor and students move out to an elementary school center during the third week of each quarter - class and participation is facilitated on the elementary school site allowing for an intense and integrated learning experience as classroom teachers attend the university "classroom" and the professor fulfills a role as teacher-colleague-evaluator-resource person-media specialist-etc. in the elementary school) ensures an effective working relationship between the university and elementary school...a relationship which strengthens the commitment to environmental education in both institutions.

Nature Trail

Environmental study areas on the campus (including parking areas, landscaped grounds, drainage ditches, heating and cooling apparatus...and a designated nature trail) allow students to have learning experiences in various indoor and outdoor habitats, and to plan instructional involvements for elementary school boys and girls.

Guidebooks for learning on-and-about the nature trail have been developed for elementary school-age groups. University students in elementary education serve as guides and resource persons when learning groups visit the campus to explore and experiment in alternative learning environments.

Environmental Education Workshop and Alternative Learning Environments Workshop

Workshops are available to undergraduate elementary education students during the summer quarter, and independent study opportunity is offered every academic quarter in environmental education and related areas. Workshops allow students to acquire an in-depth knowledge and appreciation of the field of environmental education, and to develop an extensive resource file of related teaching materials for teaching-and-learning. The hands-on approach in the workshops is the obvious opportunity for students to make learning devices for study in the out-of-doors, and furniture and equipment to transform the indoor classroom. Triple-wall cardboard is used extensively to create learning centers and science corners; "nerf" materials are collected to make buddy binoculars and measuring instruments.

These concentrated experiences of planning for an environmental emphasis in the various subject areas of the elementary school are extended and reinforced in the workshop format as the class studies and explores the busy intersection of inner-city square, the heating plant of an elementary school (very accessible in the summertime.), an abandoned farm site, or a nearby cemetery. In addition, each student may select a topic of interest; after researching a specific question(s), the results of the investigation are reported to the total group in both oral and written form.

Student Involvements

There is a concerted effort to encourage students to become involved in supportive, related, and worthwhile activities. The campus student education association, "Division of Teacher Education Students," provides an out-of-class coordination for the L.A.T.E. program. Activities often focus upon educational experiences and service projects in alternative learning environments. Faculty lead students to the Glen Helen (Yellow Springs, Ohio) "Environmentalizing the Classroom" workshops, to seasonal conferences of the Department of Natural Resources, and to meetings and conferences of environmental organizations such as the Ohio Conservation and Outdoor Education Association. Study trips are taken to environmental areas at Dawes Arboretum, Flint Ridge, and Blackhand Gorge. Students provide in-service workshops for teachers and educational aides in the development of materials and techniques for environmental education.

Each spring, opportunities are identified for student employment as leaders, counselors, and teachers in summer programs which emphasize or incorporate environmental education experiences. Faculty identify possible employment situations as they attend state and national professional meetings, and as they maintain contact with environmental educators in various sections of the United States.

Other Campus Faculty

Attempts of the education faculty to develop a cohesive teacher education program with an emphasis on environmental education was encouraged, and aided, by other faculty on the OSU-Newark Campus. Environmental education interests had been identified as science and humanities faculty members led field trips to ocean habitats, held bird-banding and study sessions on the campus site, and installed weather environmental recording devices on the roofs of campus buildings.

Interdepartment and intercollege efforts have evolved from geography and education professors providing learning experiences at strip-mine sites in Southeastern Ohio, and from science and education professors serving as faculty members on the nature trail development committee.

A spirit of "working together on environmental education" has helped identify individual faculty evolvement and expertise in this area, and has encouraged others to become involved in workshops and individual studies related to this field. The recognition of environmental interests is far-reaching - an instructor in a technical college sharing the OSU-Newark campus conducted a state population education meeting early in 1977, and an inter-department publication listing the alternative learning environments of the Licking County area has been published.

Resident Environmental Education

The environmental education emphasis culminates in an in-depth experience during the student teaching spring quarter when instructional roles are filled by university students in area resident programs. The camp experience is supplemented by pre-camp classroom preparation for learning in the outdoor setting and by post-camp, follow-up activities when the pupils, teachers, and student teacher return to the indoor classroom.

During the resident program, the student teacher accepts the teacher's responsibilities for guiding learning at the camp, and for all other teacher assignments such as staff-planning weekend retreats, parent-orientation evening sessions, planning meetings with counselors and coordinators, dormitory supervision, physical plant work crews, recreational activity leadership, and evening camp programs.

Summary

These ideas for incorporating environmental education into the undergraduate work of an elementary education program - while reflecting the Newark campus facility, faculty, and clientele - can be implemented at other institutions. It is not suggested that this program will provide, for every pre-service teacher, an adequate background for teaching an environmental education emphasis in the elementary school. It has, however, enabled the graduates of the L.A.T.E. program to "open up" to the possibilities of vitalizing the elementary education program with timely and investigative learning experiences in the environmental education realm. Follow-up study of L.A.T.E. graduates in the Licking County area is on-going; to date, the following assessments have been made:

1. Beginning teacher graduates of the L.A.T.E. program utilize alternative learning environments in their first year of teaching;

2. L.A.T.E. graduates maintain contact with the OSU-Newark faculty and continue to attend environmental education workshops and conferences;

3. L.A.T.E. graduates tend to be supportive of the Resident Outdoor Education program in the local school systems;

4. Faculty at the Newark Campus who are involved in the L.A.T.E. program have administrative and peer support for the environmental education coordinating theme in the Early and Middle Childhood Education program.

It should be noted that facilities and materials are not the critical factors in the design and implementation of an undergraduate program in teacher education with a focus on environmental education; an effective program can be developed in an urban setting, utilizing city streets and vacant lots and teacher-made equipment. The key ingredients are administrative recognition of the importance of environmental education for all elementary education students, faculty who have interest and ability in working with students in the development of techniques and materials for environmental study, and cooperative school systems which have moved, or are willing to move, toward providing environmental education for boys and girls.

Additional components of the L.A.T.E. program currently under study are:

1. Study trips to alternative environmental education programs - with an emphasis on the adaptation of learning to the locale (inner city, lakeshore, mountainside, etc.);

2. Cooperative training program linking the resources of the university, elementary schools, and outdoor centers; one format might be a summer school for in-service teacher education utilizing an area nature center and staff - with classes for elementary school children over a two- or three-week period;

3. Extension of the undergraduate program by the formation of an alumni group, with in-service meetings during the year at which members would share innovative teaching ideas and participate in study trips to creative environmental education study sites;

4. Extension of the idea of a study site (the nature trail) by developing guides for teachers and pupils as they investigate various near-school habitats (environmental learning in a cemetery, ecological study of a city block, etc.);

5. Establishment of an advisory community-school-university committee for environmental education for the guidance and encouragement of related programs in all area schools.

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THE ENVIRONMENTAL STUDIES PROGRAM AT MOREHEAD STATE UNIVERSITY, KENTUCKY

by Jerry F. Howell, Jr.*

With the end of their federal funds, many environmental studies programs instigated with EEA grants sank without a trace in seas of local indifference. Not so the case at Morehead State in Appalachian Kentucky. Energized with "soft" money in 1971-73, the Morehead State program is now anchored in the University's School of Science and Mathematics. Program focus is on the undergraduate training of "environment professionals." Of the first 35 majors, 31 have found environmentally-related jobs in a variety of fields. Curriculum options include field work and internships. Through distribution of the Director's excellent annotated environmental education bibliography, Morehead State has had a national impact.

Introduction

A distinction between "environmental studies" and "environmental education" has evolved, at least on university campuses, during the past few years. Environmental education curricula at most schools are concerned primarily with teacher training at the graduate level, although some courses and programs do exist for undergraduates. Environmental studies curricula are generally geared to the preparation of environmental professionals.

Environmental studies curricula generally fall into three categories, or modifications of them:

1. Two-year environmental technician programs,

2. Four-year interdisciplinary programs with a core curriculum and specialty options, and

3. Four-year programs with individual departmentalized curricula.

Modifications are commonplace; Mackin's (1971) "interchangeable environmental technician" cluster-career matrix, further delineated

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by Pratt (1971b) is a combination of 1) and 2). Many universities combine 2) and 3). The Morehead State University curriculum follows 2).

Most papers on university programs stress individual courses or degree requirements. These are fundamental concerns, but there is much more to a total university program than curricular frameworks. Funding sources, administration, facilities, teaching certification possibilities, employment preparation and available staff are all important considerations in program success.

Morehead State, a medium-sized (7500 students) liberal arts university in Appalachian Kentucky, has had a steadily growing environmental studies program since 1971. This paper examines each segment of the program in detail, as chronologically as possible.

Funding

The Morehead State program began with "soft" money. After a successful 1971 Environmental Teach-In, funded by the U.S. Office of Education through the Educational Professions Development Act, the university received two grants, in fiscal years 1971 and 1972, from the newly-formed U.S. Office of Environmental Education (OEE). The three grants amounted to more than $80,000 in direct funds and in-kind matching (averaging about 30 percent), enough to hire a Director of the Center for Environmental Studies, a secretary and some full- and part-time help. Additional support came from the university's workship and graduate assistant programs.

The Teach-In provided twenty inservice teachers with classroom instruction and exposure to curricular materials and teaching methods. The Teach-In was coordinated by two biology faculty members and no new personnel were hired until the university received the first OEE grant. A grant director was hired with 50 percent of his time devoted to the grants program; the other 50 percent was spent teaching and instituting an environmental studies curriculum.

The first OEE grant involved determining the environmental "awareness" level of people in a 49-county area of eastern and south-central Kentucky. Questionnaire surveys of school personnel and organizations dealing with the environment, citizen interviews, and testing of secondary students were used for the determination. Other methods used, objectives, and study recommendations may be found in the published methodology (Howell 1974).

The second OEE grant in 1972 and 1973 involved the preparation of an environmental education bibliography (Howell and Osborne 1975), the production of television programs, and the distribution of packets of environmental information to teachers and lay groups.

It is doubtful the program would have reached its present status if not for the initial grants. The grants helped provide office space, clerical help, publicity, and a curricular planning base. In addition, they helped spark student interest in the proposed new curriculum and provided time for university personnel to become acclimatized to environmental studies on campus. In 1973 the university absorbed the total program cost and in the spring of that year a minor in environmental studies began.

Curriculum

The environmental studies minor consists of 21-22 semester hours of interdisciplinary credit. Six of the hours are in the geoscience department (Oceans, Geoscience 240, three hours, Environmental Geology, Geoscience 376, three hours), four hours are in science education (Population, Resources, and Environment, Science 355, three hours; Seminar in Environmental Studies, Science 471, one hour), three hours are in biology (Environmental Biology, Biology 356), and three hours are in political science (Politics of Ecology, Political Science 505). This sixteen semester hour core is supplemented by five to six hours selected by the student from the following: Social Ethics, Philosophy 303, three hours, Statistics, Mathematics 353, three hours; Conservation of Natural Resources, Geography 505, three hours; Environmental Economics, Economics 501, three hours; Environmental Testing Methods, Biology 357, two hours; and Workshop in Environmental Biology, Biology 553, three hours.

The minor is intended to supplement another major, commonly either political science, recreation, geography, biology, geology, chemistry or earth science. Students are not limited to those majors, but rarely do they elect a music, art, or other humanities major. The minor is also elected by some students without specific employment goals in mind; they are simply curious about the natural world. Some minors have obtained employment in the environmental field, but most of the jobs go to the majors.

In the spring of 1974 the environmental studies major was instituted. Because of the depth and breadth of the environmental field, we decided to study existing programs. A committee was formed to review the UC-Santa Barbara, Dartmouth, University of Virginia, College of the Atlantic and other such programs, including that of UW-Green Bay. The resulting curriculum predictably adopted some of all programs studied, in addition to some concepts and courses different from each of the other programs.

It was felt that simply pulling existing courses together and calling them an interdisciplinary major was not satisfactory. The proposal to the University Curriculum Committee contained syllabuses for seven completely new courses. A proposal of this magnitude and structure seldom glides through a committee composed of members from entrenched departments, some of whom feel that their vested interests are at stake. The proposal did meet some resistance and compromises were made in some instances, but the proposal emerged with its basic structure and the seven courses intact.

The major consists of a core group of courses, including most of those in the minor, which every student major must take, and optional specialties, one of which the student must elect. The four options are ecology; geology; social sciences and economics; and chemistry and physics. Choosing one of the options gives the student a chance to specialize somewhat, while also receiving a base of general courses. Supplemental courses are also required of the major; these include courses which are considered either necessary to basic understanding of environmental principles or which can be utilized as research or problem-solving tools. Although supplemental courses vary with the option chosen, they include such subjects as chemistry, physics and statistics.

The ecology option consists mainly of basic biology and field courses. Examples include invertebrate zoology, vertebrate zoology, botany, limnology and ecology. The geology option includes such courses as physical and historical geology, coal mining geology, and geology electives. The social sciences and economics option includes subjects such as basic economics and sociology, climatology, economic geography, pressure groups and politics, and public administration. The chemistry and physics option is composed only of courses in those disciplines, such as general chemistry and physics, organic chemistry, instrumentation, and nuclear science.

The core is 19 semester hours, the option specialty averages 20 hours and the supplemental group averages 14 hours. The mean total of 53 semester hours is unique on campus; the typical major in other disciplines takes about 36 hours, including supplemental courses. The remainder of the student's program consists of general education courses required by the university, a minor and general electives.

The curriculum is designed to produce professionals in a variety of environmental fields, but it can also be used to obtain a secondary teaching certificate. Kentucky (like most other states), as a matter of philosophy and choice, does not grant a teaching certificate in environmental studies. But if a student major carefully plans a curriculum, the latitude of the program permits qualification for a certificate. For example, a student could minor in biology (21 hours) and use the biology courses (24 hours) in the ecology option of the environmental studies major to more than satisfy the general state teaching requirement of 30 hours in biology. Student elective hours, in this instance, are taken up in professional education hours and student teaching. Other combinations are possible for teaching certificates in other fields.

Administration and Staff

The Center for Environmental Studies is in the School of Sciences and Mathematics. This is not unusual among environmental programs; Pratt (1971a) reported that almost half the university environmental programs surveyed by the Center for Curriculum Design at Kendall College were in science departments or schools. The Morehead State program, however, is not a part of the biology, geology or any other department. It is a free-standing and separately funded entity answerable only to the Dean's Office. Major decisions are made by the Director, who acts with the same authority as a Department Head. A cross-sectional committee, representing six disciplines, must approve curricular changes before the school or university committees receive them. This administrative arrangement is not common (Pratt 1971a).

Courses in the curriculum are not labelled "Environmental Studies," but are housed within long-standing departments. The courses are offered on a regular basis; for example, Environmental Economics (Economics 501) and Politics of Ecology (Political Science 505) are taught each spring, while Environmental Geology (Geoscience 376) and Ecology (Biology 561) are taught only in the fall. The schedule is regular and well known by students and courses are arranged each semester so there is no overlap in scheduling. Some 15 different faculty members from 11 departments teach in the program.

The staff consists of a secretary, two workships (part time) and a graduate assistant who helps in laboratories.

Facilities and Equipment

Separate, but connected, offices house the director and secretary, with a hallway leading to a student reading room and library, the Environmental Resources Center. This room contains current and back issues of about 30 popular environmental journals. A checkout system is in force and one portion of the room contains a card catalog which lists all environmental books and periodicals available in the main university library. Teacher materials, categorized by grade level and available for checkout, are also kept in the room.

A well-equipped laboratory has been assigned to the program. Although it is also used as a lecture room, it serves primarily as a laboratory for water and air testing. An equipment budget averaging about $3000 annually keeps the laboratory stocked and permits the purchase of some new equipment, primarily "hands on" equipment for student use in the laboratory and field.

Field work is stressed in the program and field trips, both short and extended, are a part of at least 12 courses. Morehead and much of northeastern Kentucky is in the Daniel Boone National Forest, and the location is well suited for field studies. Several lakes, hundreds of miles of streams, a nuclear disposal site (Maxey Flats), limestone caves, a National Geological Area (Red River Gorge), a 15-acre lake on the campus, strip mines, air sampling stations and solid waste disposal sites are all within an hour's drive.

The university was recently deeded a 52-acre wooded tract on Cave Run Lake: Ten acres will be developed, but the rest will remain in a natural state. An adjacent 282 acres, owned by the family who donated the property, is available for outdoor studies and the entire complex will be a boon to the environmental program.

Enrollment and Employment

The environmental studies minor began with 10 students in the spring of 1973. During the next year enrollment increased to 37, but dropped to 20 in the fall of 1974 because many minors switched to the major when it became operative. The number of minors has since remained relatively constant; there are presently 22.

The major has shown rapid enrollment growth. It began with 23 students in 1974 and grew at an average rate of 20 students per year. Enrollment was 83 in 1977-78. The increase has been in spite of a relatively stable university enrollment.

Graduates with the major have compiled an enviable track record in securing jobs in the environmental field. Of the 35 graduates to date, 31 have found environmentally-related jobs. Four of this year's graduates are working for state agencies: one as a strip mine inspector, two as water quality control specialists, and one as an environmental sanitarian with a local health department. Five are working with private industry in air pollution control, in water and wastewater engineering, and in environmental geology. Two are secondary teachers, two are working for environmental consulting companies and one is a recreation specialist with the Boy Scouts of America.

Miscellany

Corollary aspects in program development have gradually evolved. There is a small, but active, cooperative education facet. Eight students have co-oped with organizations such as the Union College Environmental Education Center, the Area Health Education System, the Gateway Area Development District, the Kentucky Department of Fish and Wildlife Resources, and a local strip mining company. These students take a semester off from their regular academic studies and work, usually at a pay scale comparable with their peers. This part of the program is considered very important and will be expanded.

The students have formed an Environmental Studies Club. The club functions in service, social and fund raising activities and is presently involved in a campus beautification plan.

Several environmental conferences and workshops are held on campus each year. Although their roles vary, the students usually participate, plan, and/or attend most of these conferences. Conferences held during the past year include environmental impact statement writing, noise pollution, environmental education (an acclimatization session), the energy crisis, world hunger, and energy education. A three-hour credit workshop in environmental biology, stressing environmental education, is offered to in-service teachers at an off-campus location each fall and spring and on campus during the summer.

The director and other personnel lecture to civic groups and present programs to local high schools several times a year. A newspaper series, "Our Fragile Earth," written by the director, is distributed to 58 weeklies. Through May, 1978, 200 articles have been distributed.

A jobs seminar is presented each semester during the required seminar in environmental studies and an active employment file is kept in the office. Recruiters also interview students nearing graduation at the university's Placement Center.

Summary

Morehead State University has an environmental studies program consisting of an interdisciplinary major with four specialty options and a minor. A director coordinates the program, which stresses academic preparation, but supports corollary activities such as cooperative education, campus conferences, public information and job placement.

Begun with federal money, the program is now funded by the university. Emphases may be altered in the future and personnel may be added but the basic program will be left intact.

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ENVIRONMENTAL EDUCATION IN THE CHANGING UNIVERSITY

by Philip H. Jones*

Not a case study of a particular environmental studies program, this insightful and provocative essay rather analyzes where such programs in general seem to have come from, what today is their peculiar stance, and where they may be going. Where presently multidisciplinary centers tend to revolve around or bounce among the "eminent" disciplines, Dr. Jones foresees a time when the situation might reverse itself, with the disciplines "supporting a transdisciplinary community of scholars viewing the field of knowledge in a holistic way." He grants, however, that such a change would occur only with "appropriate kicks and screams,"

Introduction

To many people, environmental education (EE) is synonymous with the study of environmental sciences. This view would in turn demand a definition of the term "sciences" to include both natural and social sciences. However, the adjective "environmental" has so many different meanings to different people that we end up with many meanings to many people. The most widely accepted definition of environmental sciences and therefore of environmental education would therefore be, "Environmental education is what I say it is."

This lack of concern is at least one of the causes of the dilemma in trying to define and programme environmental education. Most people, and particularly educators, have a very private and firmly held view as to precisely what EE involves. We can thus conclude there is at present no precise and generally accepted definition for these terms just as there was no precise and generally accepted definition of the medical sciences back 100 years ago. We might, therefore, dismiss any attempt to define EE in precise terms for the moment, but rather consider it to be a pursuit somewhat like medicine which, rather than a *discipline*, might be described as a *purpose*. Medicine is being served by an aggregation of various specialized disciplines, but focuses on the purpose of restoring and maintaining the health of man. Similarly, environmental sciences are served by an aggregation of dissimilar disciplines, and focus on the purpose of maintaining and restoring the health of the environment.

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Later in this paper we shall discuss the question of environmental sciences as an emerging discipline. For this emergence to take place as an academically respectable discipline worthy of attention by some of our greatest minds, we must first of all identify a body of knowledge which is central to the discipline and with which we might expect an environmental scientist to be familiar.

An analogy can be drawn between environmental sciences and theology. Unlike the formal medical educational programme, environmental education is intended for almost all ages and sectors of society. Engineers, doctors, lawyers, politicians, civil servants, and even children should have some understanding of the environment and the effect that their activities have upon it. This makes EE similar to religious studies which have traditionally been the source of our ethical behavior and indeed the basis of our social conduct as described by the laws of most civilizations.

Indeed, the conflicts which we perceive in our ethical behavior are very similar to those which we note when considering our environmental behaviour. In today's society, religious beliefs and even ethical conduct are all too often relegated to what might be described as "Sunday behaviour", with the other six days enjoying other rules.

In both cases we can see that what seems best for the individual is not necessarily what seems best for the community or the society at large. Society has in the past protected itself from abuses by individuals through a series of sanctions known as the statutes. In some countries of the world, citizens are proceeding to develop statutes to protect the environment.

Science

At the beginning of this paper, we made a decision that environmental education was a study of environmental sciences but if we look at the conventional views of science, we will find that society really has little or no role to play in the direction of planning of scientific activity.

The four theories of science planning, as outlined by Harvey Brooks (1968), only include one theory which provides for any social involvement in the planning of science and scientific research. Polanyi and Price, although with different viewpoints, both recognize science as entirely autonomous and self-regulating. Polanyi regards science more as "a delicate plant which would wilt if it were interferred with by society," whereas Price regards science as "a weed which will grow entirely independent of society and couldn't be interferred even if society wished." The second theory suggests that science is a consumer good, an autonomous cultural expression or a part of the basic purpose of society. It is seen as the creative domain of the individual. The third theory sees science as a social overhead, assumed to underlie all purposes of society. It is, therefore, carried out in a structure which in turn is patterned on the structure of knowledge. Thus, science, according to these three views, is concerned with "what is," rather than "what ought to be," and has been called by Churchman (1968) "simply a defective part of the social organization." The fourth view of science expressed by Alvin Weinberg suggests science as a technical overhead related to social goals. This is the only definition which acknowledges the relevance of society and social goals to scientific activity.

The emergence of environmental sciences has been greatly slowed by the myths surrounding the first three of these definitions of the role of science. Environmental sciences clearly have to do with studies which are responsive to both society's wishes and needs. EE is clearly constrained by the laws of nature and manipulated by the laws of man. It deals with the ambitions of the individual, and of the societies as expressed through national interest. It has to cope with the long-held view that development, and indeed exploitation, is good, and that bigger is really better.

So at what level should environmental education be aimed? As a concept in ethics, it clearly must be aimed at the family, the kindergarten, the high school, the public school, as well as society at large through adult education, media, and interest groups. As a force for intervention to protect the environment, maintain and restore the health of the environment, university level undergraduate, post graduate, and even mid-career education should be available. It is not surprising that a certain amount of confusion surrounds the subject of environmental education because it does in fact include the input of the pure sciences and also the adjustments of value systems through a code of ethics such as the great religions of the world.

Graduate Level Programmes

> "I must stress the incompetence of the established disciplines to tackle society's real problem. What we mean by discipline is an agreed tested body of method—usually analytical—that we bring to bear on problems of our own choosing. The essence of our thinking is that we cannot tackle problems that don't fit the competence of our own discipline."

So says Hare (1970). This view was undoubtedly true in 1970 and perhaps continues to be true in some parts of the world.

Societies, systems, and scholars continue to change. The environmental method (discipline) undoubtedly lies lurking, and in pieces, in the many traditional disciplines, and only requires extraction from its traditional home and synthesis with the information and method from the other traditional compartments. This synthesis requires considerable effort by committed and capable scientists. It also requires some reward for those who risk their reputation to undertake this academically "unclean" task.

Unfortunately, the reward for being first in an academic setting may be in heaven, but on our "only one earth" it often consists of some of our eminent colleagues watching and waiting with derision and glee for a foot to be put out of place in the uncharted, unknown territory. Seeking the truth in a single discipline is dangerous enough, but exploring in a transdisciplinary sense is applauded with cheers of "charlatan", "what does he know about it," "we do not know enough to say such a thing."

Part of the problem is that every specialist firmly and sincerely believes that the significant environmental problem lends itself to solutions of his own specialty (discipline or even sub-discipline). The root of this problem lies in our primary-discipline training. We are almost expected to consider our particular specialty as being of the utmost significance and others to be appropriate for lesser mortals (such as we see enrolled in other programmes).

Ward and Dubos state (1972):

> "The first step toward devising a strategy for Planet Earth is for the nations (scientists) to accept a collective responsibility for discovering more about the natural system. . . This implies cooperative monitoring, research and study on an unprecedented scale. It implies an intensive worldwide (and transdisciplinary) network for the systematic exchange (and linking) of knowledge and experience."

This challenge also implies that the instruments of society should encourage and reward such actions.

So how should we respond to this challenge? It has already been stated that environmental education must be provided at two levels. First of all, the theological awareness—ethical level—should provide a set of values and a code of behavior for everyone.

The other level should be provided to the environmental manager, planner and intervenor. At this level, international debate has been going on for almost a decade concerning the desirability of training specialists (mono discipline) with transdisciplinary awareness and communicative skills or to produce a generalist (pluridisciplinary) with some basic understanding of a broad range of specialties.

Specialists or Generalists

In pursuing this debate, we might observe that the generalist approach would lead to what we might call an *orchestrator*, while the specialist approach leads us to *intervenors*. Traditionally, we have produced *orchestrators* by experience. Managers have not usually been produced by a formal education route, but are generally drawn from the *intervenors* of society that have demonstrated leadership qualities and occasionally have received some formal management instruction, usually obtained after leadership qualities have been recognized by superiors.

Is it essential that we produce either specialists or generalists? Perhaps there is room for a limited number of *orchestrators* to direct the actions of many *intervenors*. If this seems a reasonable compromise, then the students taking the orchestrator programme should realize that they are entering on a higher-risk programme with little assurance of employability in today's society.

In Canadian terms, the generalist degree may be described as a "deputy minister's degree" and, as can be appreciated, there is a very limited market for young men or women trained in such a manner. This situation does not mean, of course, that the employers of society will continue to respond in such a manner. Society is dynamic and our educational programmes must retain a responsiveness to lead society by a short time period (2-5 years). Being 20 years ahead of your time in society is no longer punishable by being burned at the stake, but it is certainly not a desirable state of preparedness for many students.

If we now conclude that really the major present need is for specialists with transdisciplinary awareness, there are clearly two ways in which this approach can be accomplished at the graduate level. A student can take a specialized traditional undergraduate degree and proceed to a transdisciplinary more general post-graduate degree at least at the masters level. Alternatively, the reverse is considered as a possibility. This author strongly favors the former approach as it provides the student with a terminal first degree which permits him to find employment in today's society. Furthermore, a student with a general environmental undergraduate degree may have some difficulty in finding a university which would admit him to a specialized post-graduate degree without demonstrated competence in a discipline.

An OECD study on Environmental Education at the university level (1973) published the following comments on the development of transdisciplinary environmental curriculum:

> "Where can a person go for a generalist background? Courses and curriculum both suffer from the common ill of being no more than a 'laundry list' of topics with little to tie them together."
>
> "Team teaching would be fine if there were a team rather than a collection of faculty."
>
> "Project-oriented courses suffer from three major ills: ill-defined projects, lack of leadership and too little time."

With these warnings before us, it becomes clear that it is not easy to put together a synthesizing programme to serve graduate students from many specialties. It is really most logical to commence any such programme with education of staff. This education is best accomplished by undertaking team research on one or more specific identifiable environmental problems. Such undertakings are fraught with dangers and difficulties but are essential to weld together a team. The primary requisite of the members of this team is not *prima donna* excellence within their own disciplines but an overwhelming intellectual commitment to ensure the successful completion of the research project and produce a useful product. Clearly, acceptability and respectability are essential within their disciplines, but pre-eminence, while an asset in some cases, is not a necessity.

In putting together teams of disciplines, a mutually acceptable leader is essential. His unenviable task is discretely to ensure that the skills of his colleagues are real, his role of protecting the team from self-appointed prophets and charlatans is indeed a difficult one. This is a real problem and one which militates against the environmental faculty appointing staff to their own unit and exclusively controlling their own reward structure; it should not entirely preclude it in all cases, however. This matter will be taken up in greater detail later.

Scheffey, the former director of the Center for Environmental Studies at Williams College (Williamstown, Massachusetts, U.S.A.) points out (1970) that a long lead time is necessary between the beginning of an exchange of ideas among members of staff from different departments, and the time when agreement is reached and a satisfactory formal environmental programme offered. These comments had to do with undergraduate environmental programmes but apply equally well to graduate programmes.

Education Methods

The methods employed in pursuing environmental education must of course be as diverse and innovative as the subject area being covered. Furthermore, since our understanding of the environmental system and its subsystems is thought to be so poor at present, research quite naturally plays a dominant role in the educational process.

Lectures

The didactic traditional process of course may have some place in the programme. This approach would be restricted to that area of study which consists of traditional knowledge. Innovative lectures can of course be developed using the many audio visual aids, such as slides, films, and television, that are currently available.

If a transdisciplinary subject is being taught, it is essential that the student be protected from a procession of different specialists appearing week after week proclaiming incomprehensible and incompatible "facts." In order to treat the elements of such complex subjects, it may be advisable to have specialists provide the lectures. It is helpful, however, albeit expensive in staff time, to have all lecturers present for each other's lectures. This accomplishes two things. First of all, the staff educates each other, and will be more effective for the next year. Secondly, if one discipline proclaims a "fact" which is incompatible with a statement made by another lecturer, the two will be present together to argue the point to the benefit of staff and students alike.

Case Studies

By using the case study technique, dimensions of reality can be added to the problems under examination. Case studies can be examined in a student-initiated setting, in a seminar, or even in lecture settings. Cases may be selected from the immediate area of the university or may be nationally or internationally well known. The key to selecting satisfactory case studies is to ensure that a significant body of data exists for the student's use in analysis.

If local cases are available and suitable, some of the key actors in the real cases may be invited to discuss the issue with the students.

Internships

If the number of students is not too great, it is possible to include a 1 day/week or ½ day/week internship in a local office as part of the course requirements. In most agency offices (usually government environmental agencies) there are often more problems than time to study them. Students with some guidance can contribute to the solution of what may be described as a "back burner problem." This gives the non-university staff some reward for taking part in the programme and, of course, gives considerable satisfaction to the student in having aided in the solution of a "real world" problem.

The key to ensuring the acceptance of this approach is to make clear to the agency that you are not seeking a research grant or otherwise encumbering their budget. Coming from a university staff member, this approach will undoubtedly shock government servants into submission. Cautious at first that the project may still somehow cut into their budget, when they are finally convinced of your sincerity, they will be doubly pleased with the result. The second year of this programme will be a resounding success.

Problems assigned in this category must be carefully selected jointly by the university staff member and the staff of the cooperating agency. Frequently studies may take too long to fit satisfactorily into the course time-frame. A further possible benefit can be to use two or more students of different disciplines on a single problem, with the obvious benefits of team study.

Seminars-Colloquia

Colloquia are informal discussion meetings initiated by the students, and are to be encouraged in both formal and informal settings. Seminars are a little more formal and enjoy the guidance of one or more professors. One may expect that the staff will learn more from seminars than the students during the early years of an environmental studies programme. Colloquia are therefore recommended for staff before they undertake the graduate programme offerings.

Seminars, in the form of guest lectures, are a very valuable means of creating a corporate identity to a body of different students and staff. Often a weekly or monthly guest lecture may provide the only forum where all the staff and students meet at any one time. The corporate nature of transdisciplinary studies is one of the most difficult characteristics to create and maintain. Any activities which cement these bonds should be actively pursued. Lunch rooms, coffee parties, divisional lunches, and even celebrations at the local licensed hostelry are significant parts of the educational process.

Real-World Research

Environmental education has to do with the preparation of students to identify and solve society's problems. Clearly, therefore, research undertaken by students as part of their graduate education must also be real, identifiable, and in urgent need of study (solution). In order to make such a feature available, it is necessary to have an ongoing set of appropriate research projects. If the university is large, it is not difficult to maintain a number of long-term ongoing mission-oriented research projects. If, however, the size of faculty involvement is small, it may be desirable to relate teaching programmes to ongoing government or industrial research activities.

Sensitive Issues

University staff enjoy a rather special place in society. Many of them enjoy tenure which traditionally was given to provide them with the right to criticize the government of the day without fear or favor. This special place carries with it an obligation to speak out on sensitive environmental issues. This is not to say that environmental education programme staff should develop into an activist group (sometimes called "econuts"), but it also does not mean that the environmental staff and students should dodge sensitive (therefore important) issues.

Very few scientific endeavors can be truthfully called "value free," and therefore values are indeed applied (by default if we don't do it consciously). Scientific credibility is similarly important and can be maintained by never attempting to present to the public or press an "institutional position." First of all, such a thing would be impossible, it could only be the aggregate views of those people polled, so why not say that is what it is.

Undoubtedly, this issue will create tension within the environmental unit, but credibility will be lost with the students if the programme appears to be sidestepping important and socially relevant issues. Furthermore, it is healthy to "do battle" with some of the inertial forces of the "establishment." Much is learned of our processes of decision-making in this encounter, and the lessons of losing are invaluable.

The line to tread is thin indeed. To maintain absolute credibility in the eyes of all the contestants in the environmental battle is not possible, and this must be recognized at the outset or it is worthless to proceed. However, groups of staff and students can publish findings on sensitive issues and provide these reports to the agencies empowered to take action. It is even reasonable (some would disagree) to add a footnote stating that this report will be released to the press in 21 days. This provides the agency with the opportunity to "discover" the problem for themselves and even occasionally use your recommendations for corrective actions.

Institutional Problems

The study by OECD (1973) yielded a number of comments on problem-oriented research and education, of which the following represent a few:

> "Anything to break down compartmentalization is needed." (Professor of Engineering)
>
> "There is a general difficulty in relating a discipline to a problem—that is the faculty—either they were not trained in problems or they forgot." (Centre Director)
>
> "I would emphasize the 'Historical Accident' in setting up academic disciplines." (Dean of Arts)

Traditional Disciplines

As the body of knowledge increased in the field of natural philosophy, the knowledge and with it the areas of study, were subdivided into what we call today "disciplines." Defined in the Oxford Dictionary as a branch of instruction or a department of knowledge, disciplines have served the scientific community and the development of new knowledge very well over the years. In rolling back the frontiers of knowledge in specialized and limited areas, disciplines are both fundamental and indispensable. However, in the process of integrating existing knowledge to synthesize solutions to transdisciplinary environmental problems of social significance, it is fair to say that disciplines inhibit progress. This is not to suggest that disciplines have outlived their usefulness and should be disbanded. It does suggest that a new and innovative approach must be taken to environmental education and that the "traditions" of disciplines must not hinder this progress.

Most universities are based upon these "watertight" disciplinary compartments. Teaching units are administered and budgeted within these special divisions of knowledge. Staff are trained in them, appointed in them, and progress in their careers within them. They evaluate each other within the constraints of the discipline and allocate the rewards within the same compartments.

Colleagues who wander from the "tribe" are viewed with suspicion (and even hostility) by the tribal councils. Young "warriors" (assistant professors) may not be granted full membership (full professor) in the tribe if they spend too much of their time in neighboring territories. The tradition of tribalism is so strong with many disciplines that members fail to recognize the value of their neighbouring disciplines in solving global problems.

Each discipline tends to perceive global problems within the framework of the specialty, and to see solutions through the same framework. The faculty then sees themselves as being the saviours in environmental terms: "Just give us more research money and there will be no problem to our solutions."

Centres and Institutes

If disciplines are perceived as tall vertical structures, then centres and institutes surely are horizontal structures which tap and draw from the disciplines to blend solutions to complex problems.

In order to cope with this strong vertical structure, some of the senior academics, showing a somewhat catholic (meaning interested in universal knowledge) outlook, established new horizontal structures to study problem areas drawing on more than one discipline. Such areas as criminology, policy analysis, medieval studies and drama have responded in various universities by forming centres or institutes. By reviewing the centres which were founded decades ago, one will soon observe that they have traditionally been related to one group of disciplines (humanities, social sciences, or natural sciences). Few, if any, centres have ever attempted to draw together the knowledge of such a broad group of disciplines as have the environmental centres.

Anyone who has been involved in the development of such a centre will immediately realize that he and his embryonic unit are viewed by the budgetary heads (tribal chieftains) as a threat to their financial well-being. This threat of course is true. With a limited budget, any new inter- or transdisciplinary creature with a separate identity must divert resources from the traditional focus, the discipline departments.

It is quite irrational to criticize severely the departmental chairmen for their instinct to protect their tribes. What else are tribal chieftains for?

Centres and institutes are usually populated with senior tenured staff, well past their innovative prime, a few post doctoral fellows supported on "soft" (contract) funds, together with even fewer juniors, energetic, overworked and totally dedicated academics. Together they usually enjoy a minuscule proportion of the total budget of their parent institution, but far more than their share of public visibility when that university is called upon to prove its relevance and value to society.

With all its shortcomings and weaknesses, however, the centres or institutes have proven to be the most popular organizational vehicle to mount environmental studies. The reason for this is undoubtedly the fact that being politically weak and commanding few if any of the committed resources ("hard" money budget) and rarely having any tenured appointments, it is a relatively easy organizational structure to establish. To convert such an organization into a faculty or other permanent budgetary unit is infinitely more difficult as a rule.

As environmental studies move inexorably towards the kind of "purpose" that medicine and engineering have achieved, so the problems of university inertia will become more apparent.

Motivation Problems

In environmental education, there are two areas of motivation which must be confronted. The motivation of academic staff is of primary significance, followed by the second area of motivating students.

Staff Motivation

The two forces of motivation which appear to influence the behavior of academic staff at universities and colleges are personal commitment and reward structure. The relative emphasis of these two forces varies throughout the career of an academic.

When a young scientist joins the university staff, he is probably at the beginning of what he perceives to be an eminent academic career. He is normally appointed in a department in a faculty or college. His progress depends upon his success in impressing his senior colleagues with his publications, teaching, and innovation within that discipline. He may have a commitment to a transdisciplinary pursuit, but he soon realizes that such an activity must be undertaken in addition to his purely disciplinary activities. It is only the very talented and committed young assistant professor that dares venture into the latter maze of demands.

The result is that most environmental institutes are staffed by senior tenured staff whose financial and promotional rewards have already realized their full potential. In this case, commitment becomes the major motivating force, with declining energy associated with declining years being the major constraint.

Student Motivation

Students are frequently motivated by causes and social issues. They are also, in their more sober moments, motivated by career potential. Thus in selecting and accepting students for a graduate environmental education programme it is necessary to evaluate the relative weight of these two components of motivation.

Some universities* actually go so far as admitting students by a selection process that involves an interview. In this way, the staff gets a better understanding of the degree of commitment which is so important in profitting from such a programme. Interviewing candidates also allows for a mix of maturity, disciplines, and careers.

A good environmental education programme includes student-to-student education, which can be and should be a vital and significant part of the process. The first experience of transdisciplinary study is usually traumatic, and motivation to succeed is important. The student's desire to "do well" in his studies is and always has been a major motivation. This is particularly true at the graduate level where the age, experience, and responsibility of the students varies so considerably.

A transdisciplinary programme of environmental studies can be and must be an exhilarating experience to be enjoyed rather than suffered. The staff will be rewarded by an exhuberant student response if the faculty design the programme effectively and perform their task well. There can be no comparison for suitably motivated staff and students between this transdisciplinary educational pursuit and the somewhat dusty (but necessary) studies of pure disciplines.

The Evolution and Revolution of University Education

In order to see where we are going with innovative educational programs such as environmental studies, it might be well to look back to see where we have come from.

In ancient Greece, the highest life was one of cultured leisure with all energies devoted to the pursuit of knowledge for its own sake. Later the Arab rendition of Greek works, together with the newly established communication with the Moors of Spain, profoundly affected both the culture and education of the day.

After a lengthy period of turmoil in Europe, the 11th century brought relative stability and permitted society to pursue knowledge once again. The Roman Catholic church controlled education at that time. Only the clergy were able to read and write; Latin was the medium of writing. License to teach was granted by the cathedral church.

The primary objective of the medieval university was to preserve the body of learning by ensuring an unbroken succession of recognized teachers in arts, law, theology, and medicine. Masters and pupils residing in the same town would constitute a university.

The University of Paris was one of the first universities; it came into being between 1150 and 1170, although it wasn't until the 13th century that it was legally incorporated. International in its student population, it had faculties of Arts, Law and Theology. Although separation of fields of learning was beginning, the age of specialization as we know it certainly had not arrived.

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*University of Adelaide, South Australia

Medieval universities taught medicine but did not deal with surgery, which was still the domain of the barber. Montpellier, France, was recognized as one of the first schools of medicine in the 12th century, but even so medicine was not kept alive by universities. Rather it was the College of Physicians founded in 1518 which was responsible for the preservation of the healing arts. It was not until 1745 that the alliance between the barbers and surgeons was broken. In 1800 the College of Surgeons was founded.

In the 19th century science and knowledge were expanding at a rate that had hitherto been unknown. This was the century of Faraday, Joule, Darwin, Lister, Pasteur, and Koch. Despite all this ferment, the curricula of higher education remained relatively untouched in Europe: the first living example of a law of "nature" which is now well known, "Nothing can be done for the first or last time at a University." Those developing environmental education in today's universities know this law well.

All research was being conducted outside of the university setting in that century at such places as the Royal Society in England and similar institutions in other countries. Cardinal Newman in 1852 said that the task of a university was to prepare young men (not women*) "to fill any post with credit and master any subject with facility." Thus the university was clearly a pursuit of gentlemen. The hard and productive outer world of research and new thought was typified by Rene Descartes: "Prove everything by reason and accept nothing that fails to meet the test."

During the years that followed we have seen the development of technology and the blending of the plebian skills and techniques with the aristocratic sciences of the 19th century. Specialization is a phenomenon of this period.

This is where we came from; now where might we reasonably expect to go from here? Perhaps we might seek interdisciplinarity as a means of establishing the truth. The age-old quest of the scientist after the truth has led many of the sincere and faithful academics into radially directed passages which become narrower and narrower. The time is fast approaching where we should scale the walls to see where we are:

Guy Berger of the University of Paris VIII (1972) concluded:

> "The presence of interdisciplinarity no longer appears to be a mere readjustment or improvement of traditional divisions in science, or better adaption of the university to social function. It is becoming a whole battery of questions about the goals and functions of the university, and about the status of knowledge rather than about how it is divided up. Once again we find we are confronting a world-wide approach to the reality of universities. This approach (interdisciplinarity) can certainly carry on the scientific movement, fits a large number of its requirements, calls for tight theoretical thinking, and above all shows that the university system is tackling

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*It was not until the 20th century before women were admitted to degrees in England.

> more day-to-day and commonplace, and less well defined issues concerning the relationship between man and the world, with knowledge, with others and with himself."

Inter- or transdisciplinarity is not an end in itself; rather it is a place from which to view the world of learning, permitting reflection and stimulation.

The renaissance of education is over. Society is demanding more for its investment. The whole educational process is under political scrutiny, and many educators are crying 'political interference'. Perhaps what has really happened is that someone was innocent enough to point out that "the King has no clothes on." Society is rife with problems (the preservation of the environment is just one of them), and many scientists continue to pursue their hobby at society's expense.

The university of the future will undoubtedly have to deal with society's problems by training and educating the next generation in relevant ways. It may be that there will be no standard qualification in the future. Even today a B.Sc. or a B.A. has little or no meaning without examining the subjects included.

Furthermore, the date on the parchment will become increasingly important in these days of exponential discovery. Perhaps we must look for a recurring educational experience; every fifth year returning to a formal teaching-learning experience, perhaps for a year, perhaps for a month, but certainly some formal time.

The place of instruction and education may not in the future be the classroom; it may be the workplace or even the home. The ages of students will probably cover a greater spectrum and the qualification for admission may relate more to commitment and experience than to prior educational milestones.

Deferred enrollment for certain programmes may very well assist in optimum intellectual benefits for the student and for society.

The university of the 21st century will most certainly have to provide a more responsive education to meet and indeed lead society's demands. It is unlikely that the pristine disciplines will survive this challenge as the havens of eminence and pre-eminence. That they will survive is certain, indeed essential, but their dominance will gradually diminish (with the appropriate kicks and screams) until they fulfill their real function, that of supporting the transdisciplinary community of scholars viewing the field of knowledge in a holistic way.

To those who say "we will not live to see it," we might reply "we might not survive without it." Our future, our civilization, and our survival surely depen upon our dealing with environmental education now.

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THE NEW JERSEY SCHOOL OF CONSERVATION: A UNIQUE EDUCATIONAL EXPERIENCE

by John J. Kirk*

Dating from 1949, the New Jersey School of Conservation may well be one of the oldest sustained programs in the country in what is today termed higher environmental education. Drawing its first philosophical orientations from L. B. Sharp's "outdoor education" approach, the camp at one time was a required experience for every sophomore attending a New Jersey state college. Now the focus is on providing elementary and secondary school students, college students and in-service teachers with field experiences intended to increase their awareness of environmental problems. The School is administered by Montclair State College for the State Department of Higher Education. It enjoys formal faculty exchange relationships with conservation education programs in Canda and Japan. The School also conducts a children's summer camp. Its Director serves as President of the New Jersey State Alliance for Environmental Education.

During the mid-1940's a group of concerned educators and interested conservationists felt that the State colleges of New Jersey should have a field campus. After considering several sites in the state, a decision was made that the Skellinger Group Camp, built by the Civilian Conservation Corps in the late 1930's and located in Stokes State Forest, would be the ideal setting. After much deliberation between the various departments of State government and the administrators of the State colleges, the consensus of opinion indicated that such a field campus was needed, and in the spring of 1949 the New Jersey State School of Conservation was established.

Since the buildings and land belonged to the State Department of Conservation, which has since become the Department of Environmental Protection, an agreement was drawn up between that Department and the State Department of Education, making the former Group Camp of approximately thirty-five acres available to the Department of Education for a State conservation education center. Later an additional 205 acres were added to the lease agreement, bringing the total acreage of the School up to 240 acres.

Dr. Kirk has been the Director of the New Jersey School of Conservation, Branchville, New Jersey 07826 for the past 15 years. In addition to his administrative and supervisory responsibilities he serves as a Professor of Environmental Studies, teaching courses at both the field campus and the main campus of Montclair State College. He is a past national president of the American Camping Association and past national chairman of the Outdoor Education Council, and has lectured extensively on the topics of Outdoor Education and Environmental Education throughout the United States, Canada, and the United Kingdom.

The original plan for the School of Conservation was to utilize the facilities of the former CCC camp to provide programs of conservation education for the faculty and students enrolled in the State colleges and also for the school children of New Jersey. During the early years administration of the School was delegated by the Commissioner of Education to Montclair State Teachers College as part of its extension program. This decision was made because the majority of courses to be offered at the School were designed for graduate students, and Montclair State had a large enrollment of teachers in its graduate program. For the first nine years the direction of the School of Conservation was the responsibility of the Dean of Graduate Studies at Montclair State Teachers College. The first Director of the School was Dr. DeAlton Partridge, who relinquished the position after two years in order to assume the Presidency of Montclair State Teachers College.

At the time the School was established, the sum of $6000 was appropriated annually for operating costs. This policy continued until July 1, 1951, when the Director of the Budget ruled that the School of Conservation would receive only those funds which it collected for tuition and other services, making the School a self-supporting agency.

For the first ten years of operation, the programs at the School of Conservation were limited to college courses offered during June, July, and August. Camp Wapalanne, a children's summer camp, was also conducted in conjunction with these college courses. Students from all of the six State colleges which were then in existence were encouraged to enroll in the courses, but the School of Conservation was really not a cooperative effort between the six colleges until 1957. At that time the State College Presidents became increasingly interested in the programs being conducted at the School, and the first pilot group of college sophomores attended a five-day program during the first week of May. This group consisted of 60 students and 6 faculty members— 10 students and 1 faculty member from each of the State colleges. When this pilot project was evaluated, it proved to be such a meaningful addition to the college program that the Council of College Presidents recommended that all students attending the six State colleges have this experience in living and learning in the out-of-doors as part of their general education.

With the expansion of the pilot program came the need for an extended season which necessitated the hiring of a year-round director. In 1958 approval for such a position was granted, and Clifford Emanuelson was appointed as the School's first full-time director. The office and official records were moved from Montclair State College to the School site, and the administrative responsibility for the operation was assigned to the Director of Teacher Education and Certification in the Division of Higher Education, State Department of Education. During this period of time winterization of the buildings was begun in order to accommodate students on a year-round basis. The season was lengthened from approximately four months to nine months, and sophomore students were scheduled to attend five-day sessions from September to

November and from March until June. A few public school groups were also accommodated during October and between March and June. These school programs were also of a five-day duration, and the school systems were permitted to participate for a two-year period. These programs were essentially for demonstration purposes intended to provide administrative and program experiences to school systems from which they could gain the expertise necessary to begin their own programs in resident facilities other than the School of Conservation. The summer college courses and the demonstration children's camp continued to operate as previously described.

As the college program became better established and enrollment in the State colleges increased, the number of students attending the School of Conservation increased from sixty in 1957 to approximately three thousand in the academic year 1961-62, when all college sophomores were required to attend. This necessitated the utilization of the School of Conservation for the entire academic year and, combined with the various summer programs, made the School a twelve-month operation. During these early years the philosophical basis for the outdoor education programs was that of the late Dr. Lloyd B. Sharp, which can best be summarized as "that which can be best learned in the out-of-doors through direct experience and dealing with native materials and life situations should be learned here."

At the beginning of the 1963-64 academic year, the present director was appointed. During the first three years of Dr. Kirk's tenure, the college and public school programs both grew considerably until in 1967 more than 4500 college students and two thousand public school youngsters were in attendance for five-day resident outdoor education experiences. This rapid growth rate made the New Jersey State School of Conservation one of the largest resident centers in the world and focused much national and international attention on the programs conducted at the School.

During this period of time a shift in philosophical emphasis from that of previous years occurred, and the new focus tended to stress the development of a reverence for life through an ecological investigation of the interdependence of living things, and the formation of a land ethic which tends to illustrate man's temporary stewardship of the land. This approach to field study tends to stress the affective aspects of learning which contribute to the development of positive attitudes regarding man's relationship to the total environment.

Also during this period of time the emphasis of the college programs shifted from that of a general educational experience to professional education. As a result of this change, an effort was made to move the college program from the sophomore year to the junior year and relate it more directly to the student teaching experience. In this way the resident experiences at the School of Conservation could be more closely related to the training of teachers by assisting them to see how the natural environment could be utilized within the framework of the existing school curriculum. Three of the six State colleges did make the shift to the junior year, which provided a more meaningful educational experience with more relevance and meaning for the participating students.

In the summer of 1967 the State Department of Higher Education was formed in New Jersey, providing a more autonomous structure for the State colleges and the School of Conservation. As a result of this new administrative structure, the State colleges of New Jersey shifted from the exclusive emphasis on preparation of teachers to multi-facted institutions of higher learning. As a result of this change, several of the colleges chose not to require attendance of all students at the School of Conservation. Four of the six existing State colleges decided to discontinue the required resident experience in outdoor education until a complete review of the purpose and scope of the programs could be conducted. Trenton State College and Glassboro State College chose to remain in the program, and during the 1968-69 academic year they sent a total of eighteen hundred students to the School.

The school program has shown continual growth through the years, and during the 1972-73 academic year there were 6400 school children from 38 public school districts and six private schools in attendance for resident experiences in outdoor education and environmental studies. The span of the public and private school program goes from grade three through grade twelve. Combining the range of the school program with the summer months' undergraduate and graduate courses, the total educational range for programs at the School of Conservation is from grade three through doctoral candidates, which is the widest educational range of any field center in the world.

The children's summer camp, which now stresses natural science and ecological investigation, has expanded and reached the desired capacity of 94 children and 22 staff members. During the last ten years of the School's operation, many other special programs have been conducted during the summer months in addition to those mentioned. These include a camp for children with speech defects, a camp for socially and educationally deprived children, a camp for the organically brain-damaged, and in 1968, 1969, and 1970, a six-week graduate program for students completing work toward a Masters degree in outdoor education and conservation enrolled in Montclair State College, Glassboro State College, or Trenton State College.

During the late 1960's the School of Conservation began to attract additional attention as a world center for environmental studies. In 1969 a relationship was established with the Metropolitan Toronto and Region Conservation Authority located in Ontario, Canada. The MTRCA operates a network of conservation field centers in the Toronto area. Each spring since 1969 the School of Conservation participates in a faculty exchange program whereby a member of the faculty of the School will assume teaching duties at a center in Canada, and an instructor from one of the Canadian centers joins the teaching staff in residence at the School of Conservation.

In April of 1972 the School of Conservation and the Osaka Prefectural Youth Outdoor Activities Center in Osaka, Japan, were, by mutual consent, proclaimed sister centers in environmental studies. As a result of this affiliation, visiting teacher and faculty exchange programs have been initiated by both institutions. Both of these programs tend to stress a one-world concept in working toward the solution of environmental problems and enrich the School of Conservation programs by adding an international dimension, which reinforces the basic philosophical premise of the School, which is the development of a reverence for life and the formation of a land ethic. These programs also foster an exchange of ideas and techniques so important to an educational institution.

In July of 1972 the administrative responsibility for the School of Conservation was transferred from the State Department of Higher Education back to Montclair State College, School of Professional Arts and Sciences. The four members of the teaching faculty in addition to the director of the School are now members of the faculty of Montclair State College. At this time the School of Conservation has a year-round staff of thirty, including kitchen personnel, maintenance personnel, clerical personnel, and a registered nurse in residence who supervises the health programs.

The philosophy and program content have evolved with the Environmental Education movement. Each of the four faculty members in residence are specialists in one of the four major curriculum areas: Humanities, Social Studies, Outdoor Pursuits and the Natural Sciences. All educational experiences conducted with these four broad curriculum areas are designed to provide students with a better understanding and appreciation of the role that natural areas play as part of a life support system.

To assist the students to see and understand the inter-relationship, frequent references are made to their own community. Data on the communities of the participating school groups is gathered by the three resident Teaching Fellows who conduct community surveys in addition to their teaching responsibilities. These experiences in the community prove to be valuable supplements to the other graduate work the Fellows receive in their Master of Arts program in Environmental Studies.

In addition to the four faculty and three Teaching Fellows, classes at the School of Conservation are taught by the classroom teachers and the college faculty members from the participating schools and colleges. These teachers and professors have been trained in the philosophy and field techniques utilized at the School of Conservation at week-end workshops offered four times during the academic year.

The combined efforts of the resident teaching staff along with the visiting teachers provide an interesting blend of educational experiences for the participants. It also makes it more feasible and practical for the classroom teachers to utilize the knowledge and experience gained while in residence at the School of Conservation in various other curriculum activities when they return to their own schools.

In summary, the School of Conservation has as its purpose development of an environmental sensitivity which will enable all program participants to see and understand more fully the inter-relationship and interaction of all living and non-living things. The experiences at the School of Conservation combined with the other Environmental Education experiences conducted back at the school and in the community should assist in developing an environmentally literate citizenry.

INDUCTIVE CURRICULUM DEVELOPMENT IN ENVIRONMENTAL STUDIES: THE EVERGREEN STATE COLLEGE, OLYMPIA, WASHINGTON

by Robert H. Knapp, Jr.*

A college without departments or schools. Full-time, year-long courses which self-destruct annually. Most offerings team-taught. No distribution requirements or majors. A large measure of faculty and student freedom. A dream world? No. It's all been happening at Evergreen State, evolving since 1971 in Olympia, Washington. But now there are signs that traditional ways may be creeping onto the Evergreen campus. Maybe, and maybe not. Environmental studies is among the first quasi-majors, and one of Evergreen's deans has contributed this fascinating analysis of the adaptations of unorthodoxy.

Concern over the quality of the environment is not new, in this country or elsewhere. However, the latest wave of environmental awareness, beginning toward the end of the 1960's, has had more profound effects on the social fabric and on individual attitudes and actions than any before it. Colleges and universities have not been immune. It is hardly surprising that the people who were shaping the basic principles and methods of a new four-year college in the period between 1968 and 1971 responded to the fervor and the iconoclastic spirit of the times by challenging or even reversing a few central educational values. The resulting institution, The Evergreen State College, has devoted a sizable portion of its energies to environmental studies, in a way that is unusual and provocative.

Let me start with a few facts. Evergreen is a state supported four-year college, in operation since 1971 on 1000 wooded acreas in Olympia, Washington, at the southern end of Puget Sound. The liberal arts form the main curricular emphasis, but there is also considerable stress on applied work, through field research, internships, design projects and the like. Enrollment reached 2000 in the 1972-73 academic year and has grown slowly since then to the present level of roughly 2500.

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Facilities include on-campus laboratories, two waterfront field stations and a modest inventory of instruments and equipment.

Environmental studies teaching at Evergreen has occurred in most of the central areas—terrestrial and marine ecology, environmental law and policy, natural history, energy systems and policy—and has covered a few less usual topics, as well—outdoor education, boatbuilding, alternative agriculture, architecture. Enrollment in courses with predominantly environmental emphasis has been in the region of 200 students at any given time, or roughly 10 percent of the student body. According to in-house surveys, roughly the same proportion of Evergreen graduates want to pursue careers in the area, and have gone on to graduate school or to such jobs as fisheries biologist, county planner, solar heating consultant, or aquaculturist.

The most important aspect of this teaching pattern is that it is a grass-roots effort. Until this year, Evergreen has had no environmental studies "program" in the sense of identifiable units on an organizational chart or lines in a budget. The organizational units of the academic side of the college are the individual courses. These in turn are unconventional. They are full-time courses: with few exceptions, each student or faculty member works in only one at a time. Many are team-taught. Each manages its own time, space and budget, under the general guidance of four Academic Deans. There are no departments, institutes, centers, or other organizational entities between the level of the course (one to five faculty members) and the faculty as a whole (about 130 people). Moreover, most courses are given on a temporary or occasional basis. Each year, the curriculum contains a very large proportion of brand new offerings. Some courses have been repeated, but few have persisted year to year without substantial modification.

The surprisingly high level of curricular turnover has been intentional. The Evergreen faculty came to the college with strong personal commitments to their subjects, but with an even stronger commitment to vigorous experiment with both the forms and the content of college education. The norm of high turnover was adopted to create a welcoming atmosphere for new ideas and to discourage the premature freezing of the curriculum. In short, Evergreen did not set out to establish a comprehensive, coherent plan for environmental studies, or for any other subject. The basic goal was to discover inductively, by cut-and-try, what pattern of teaching would suit its faculty, its students, and its circumstances. Only after five years of exploration, and a great deal of argument, has the college begun to codify some elements of its curriculum, and that in a way designed to encourage further experiment, further testing, and further evolution.

Some remarks about the college's general arrangements will put the situation in perspective. Stephen C. Ehrmann, author of a recent NSF-funded evaluation of Evergreen, characterizes the place by two general principles and one key administrative structure[1]: 1) a pervasive desire for interdisciplinary teaching, 2) a high value placed on freedom of individuals, students and faculty, to control learning, and 3) full-time courses (each student is responsible to only one faculty member at a time).

The desire for interdisciplinary work was a natural outgrowth of the late 1960's. Typical of the mood of the period is the catalog description of the 1972-73 course "Environmental Design." It begins

> Increasing population growth, unending urbanization, diminishing supplies of natural resources and rising dissatisfaction among affluent societies with their approach to life—all these have forced man to stop and reflect on the consequences of his actions.
>
> As our name suggests, all of us will participate in designing environmentally; that is, developing an attitude and approach toward solving design problems in and of various environments. This comprehensive approach will include many human and nonhuman, physical and non-physical influences, limitation, and forces involved in design problems. Inherent in this approach is the process of planning ecologically. We are dealing with a complex system, i.e., a multiplicity of sometimes conflicting variables. Nevertheless, we must recognize and account for as many of these factors as possible and work toward a balance, a stable equilibrium, through the design process.

These words were written at a point when the country had experienced a decade of social upheaval, of war and political turmoil, and of increasing awareness of environmental degradation. Especially in the latter area, the necessity for holistic approaches had been demonstrated repeatedly and dramatically, as less comprehensive attempts foundered on unanticipated side effects. The pressing problems fell between the boundaries of existing specialties and jurisdictions. The obvious response, for the academic world, was interdisciplinary work, the attempt to study all aspects of a problem in a coordinated way.

The emphasis on individual freedom was equally a product of its time. Like most other social institutions, traditional organizations of academic work had been called into question, on grounds of unresponsiveness to external problems and lack of concern for students. Campus disturbances at Berkeley and elsewhere were only the tip of an iceberg of discontent among the nation's college students and many of their faculty. Whether these dissidents were mainly concerned with broad social questions or with their immediate personal situations is still in dispute. But whatever the underlying causes, attacks were mounted on such standard features of education as "rigid" and "irrelevant" major and distribution requirements, "impersonal" large lecture courses, lack of direct contact with faculty, and overemphasis on research.

The early deans and faculty of Evergreen reacted by institutionalizing a large measure of individual freedom. Students could choose their own sequences from among the college's offerings, free of distribution and major requirements. The extent to which a student specialized during his four years was to be up to him. An ethic grew up which allowed the student to take responsibility for his learning within a course, by minimizing the number of hard-and-fast requirements and encouraging the negotiation of individual variations in what students did. Correspondingly, the faculty were to be guided by a general ethic of humane, conscientious teaching and, in the team-taught courses, by the necessity to build and maintain team cooperation. They were to be free of curriculum committees and departmental syllabi.

There developed no national consensus about the value of interdisciplinary work or of increased individual control over learning. Even where such a consensus did emerge, existing colleges and universities frequently had great difficulty mobilizing themselves to act on it. A brand-new institution, however, could organize itself specifically to do so, and this Evergreen set out to do. The years around 1970 were sufficiently angry for drastic measures to be acceptable. At Evergreen, the full-time course is the central organizational component. Students may work in groups with one instructor, or more typically with a team of two to five faculty. Alternatively, they may work in an independent-study format under the supervision of a single faculty member. Whether in groups or on their own, students almost always engage in a variety of activities—reading seminar discussions, laboratory exercises, skill development classes, field trips, and so forth. Because these are assigned and scheduled under the aegis of a single organizational unit, the full-time course, they can reinforce each other. Their timing can be synchronized for best effect; concepts and their applications can be developed jointly, in integrated fashion. Scheduling is very flexible: students can drop everything and spend entire weeks in the field, and program activities can easily be modified to deal with unforeseen opportunities or problems.

The advantages of this sort of structure for environmental studies are probably obvious, but I will sketch a couple of specific instances to illustrate what can be done.

"Applied Environmental Studies" is the title of a course offered for the full duration of the 1976-77 academic year. About 33 students, mostly sophomores and juniors, enrolled to work with three faculty members—an environmental chemist, a land-use planner, and a marine biologist. Most of the ten-week Fall Quarter was spent in studying introductory material in these three areas, with special emphasis on field and laboratory techniques. Simultaneously, the faculty and students identified and defined a series of small-scale field studies needed by local or state governmental bodies. At the beginning of Winter Quarter, the students selected four of these, with the intent of forming project teams to contract with the relevant agency to spend the remaining 15 to 20 weeks of the year performing the study. The principal faculty role from this point on was to help the students organize their teams and to provide wisdom and technical advice on scientific, diplomatic, organizational, and interpersonal questions. The study topics were 1) water quality in

Totten and Skookum Inlets of southern Puget Sound; 2) baseline study of a local stream and watershed; 3) development of an environmental education curriculum; and 4) suitability survey of sites for artificial reefs.

The problem under study in Totten and Skookum Inlets was the familiar one of residential development pressing on environmental resources, in this case highly productive shellfish beds. The students' report describes the environmental factors affecting aquaculture in the area, the impact on water quality resulting from forestry, agriculture and residential development in the watershed area, and the political structure and citizen attitudes that are likely to shape decisions there. To produce such a document the students had to bring to bear physical, chemical and biological sampling and analysis techniques and relevant theoretical knowledge; interviewing and opinion polling methods; soil surveys; and the ability to write clearly and accurately. They had to understand the social and political dynamics of the area in order to get the necessary cooperation of residents and organizations, and to get results which could be used in the planning decisions of the county governments that commissioned the study. At the same time, they had to work scrupulously to meet the academic standards of the faculty.

What is unusual about this work is that these students, at a fairly early stage in their college careers, could make a useful contribution to a live problem. This was made possible by the fact that a) they were working on the question full time, so that they had time to acquire basic knowledge and skills and do the field research as well, and b) they had the full-time attention of a faculty team covering the needed range of expertise. Finally, the commitment to a real-world organization to provide a service provided the crucial motivation to do serious, complete work.

Some of the most impressive environmental work goes even further in this direction. Eight students, juniors and seniors, received a $30,000 grant from the U.S. Fish and Wildlife Service to do a seven-month baseline study on the physical, biological, and human resources of the Alaska Peninsula of southwestern Alaska. Assisted in the project design by a faculty biologist, they performed the field work and drafted resulting recommendations for land management largely on their own. In the same vein have been a series of NSF Student Originated Studies grants, eight in the last five years, covering topics such as reproductive success in harbor seals, tussock moth infestations, and the ecological effects of reintroducing wolves to the Olympic National Forest.

Not all environmentally-related study at Evergreen is so thoroughly product-oriented. The "Outdoor Education" course of the 1977-78 academic year concentrates on questions of attitude and value. Its catalog description begins

> The basic theme will be Education: Its Theory and Practice. The emphasis from which this theme flows rests upon two presuppositions: 1) our environment greatly influences our value systems;

> and 2) the natural transmitter of values in America today is the educational system. This emphasis leads directly to the content of the program which might be grouped under three main headings: 1) environmental trends and their probably effects on the human species; 2) human values in the light of educational trends; and 3) the role of twentieth century American education in teaching people values, both directly and indirectly. The outdoors will be used as a particularly effective means of approaching the problem of value transmission.

Descended from the Outward Bound movement, and aimed at freshmen and sophomores, "Outdoor Education" presents material on environmental attitudes, humanistic and development psychology, history and theory of education, as well as basic outdoor skills and field sciences. Extended field trips for direct exposure to the wilderness are an important activity; by requiring students to spend several days at a stretch together, these trips also develop understanding of group interaction and how to shape it productively. On-campus work centers on seminar discussions of such books as Abbey's Desert Solitaire and Dewey's Experience and Education.

The independent-study format, on the other hand, has allowed qualified students to study topics too specialized to justify the offering of a group course, to patch up an incomplete or lopsided background in preparation for advanced work, and to undertake internships with such institutions as the State Department of Ecology, the Field Museum in Chicago, and the National Park Service. Typically, a student with a rough idea for a research project or individualized study program negotiates a detailed plan of work with an appropriate faculty member, who checks the feasibility of the proposal and builds in the specific activities to be performed. In most cases, the student has a weekly conference with his faculty sponsor, but works largely on his own toward whatever final products have been specified. The recipients of Student Originated Studies grants usually enroll in this way. So have others working on everything from animal control to electron microscopy.

After an account like the foregoing, the most common single question asked by outsiders is, "But can the students get into graduate school?" The bald fact is that those who want graduate study gain entry about as easily as comparable students from conventional colleges; if anything, they do rather better once admitted. Job placements are also as good or better than average. But the question is really asking something deeper about how such a loosely organized system, emphasizing innovation and autonomy over coordination, can hope to achieve consistently high quality in its student work. How can students escape superficiality and acquire deep and thorough understanding of anything?

Apart from the physical sciences, where the subject matter is strongly sequential and provision of the introductory material in such topics as calculus has posed some special challenges, superficiality has not been an intrinsic problem in environmental subjects. Full-time courses allow for exceptional intensity of involvement, and "real world" projects, a pervasive feature, have provided objective tests of the completeness, precision, and sophistication of student work. Team teaching has made a breadth of expertise easily accessible to students. Moreover, close adherence to a 20-student-per-faculty-member class size has made possible exceptionally close contact with instructors.

What Evergreen really sacrificed was curricular uniformity. Most years have seen an offering analogous to "Applied Environmental Studies" —environmental in emphasis, project- or research-oriented, team-taught. The specifics have varied considerably from year to year. Here is a list of the expertise represented on the successive teams: ornithology/pesticides and chemical instrumentation (1973-74); terrestrial ecology, land use planning and welfare economics (1974-75); nothing comparable in 1975-76; marine biology, environmental chemistry, and land use planning (1976-77); geology, environmental chemistry, and land use planning (1977-78). There has been an informal understanding among the faculty that some course of this general sort should be offered, but there has been no attempt to specify its content in any detail. Thus the student who wished to learn a particular kind of applied environmental work faced greatly varying opportunities—one year, the chance for total immersion, the next year, perhaps nothing. The timing of the annual curriculum planning process, moreover, meant that details of the coming year's slate of courses were not available until the preceding March or April. Constant change also made it hard to develop a clear understanding of the college's strengths among prospective students.

Lack of uniformity has entailed some problems for faculty, chiefly due to the necessity of preparing new material for each year's teaching. Intellectual fatigue has accumulated to some extent over the years, but the faculty interest in innovation remains high. Instead, the principal burden has fallen on those students who wanted to plan their course of study in advance. Largely absent at the outset, this sort of desire has been increasing during the past several years, and became important enough in the fall of 1975 to set off a full-scale review of the Evergreen curriculum. The basic goal of the review was to alleviate unpredictability, faculty fatigue, and some of the tensions inherent in the desire for individual freedom for both students and faculty; and to do so without surrendering the commitment to interdisciplinary study and to substantial individual freedom. No one wanted the compartmentalization of a departmental structure, or the inertia of fixed curricula and requirements. But some codification and some greater degree of advance notice of offerings was needed.

After the debates were over, a recommendation emerged that nine so-called "Specialty Areas" be established. These organizational hybrids were defined as follows:[2]

> What is a Specialty? For students, it is a coherent, well-advertised, stable set of curricular offerings, most likely a sequence to be taken in two of their last three years in college,

> that provides them with a solid base of specific conceptual tools and specific factual and intuitive knowledge in an area, and with some opportunity to use that base for advanced undergraduate work in the area. For faculty, a Specialty is several things. It is a planning and review group that meets initially to work out what the students' "solid base" is to consist of, and how to provide it, and then meets each fall to review the previous year's events and to update its set of offerings and arrange their staffing for the succeeding year. A Specialty is an advising label, a way to tell students how to locate programs which speak to their interests. It is also a temporary teaching base for the faculty who staff the Specialty's programs—they will usually stay in the area for two years before rotating on to other teaching assignments.

Each Specialty organizes teaching on some interdisciplinary theme which had proved to have a particular vitality in the preceding five years. Environmental Studies was a natural choice. I will trace its annual cycle of operations as a specific example of how the system works.

About 15 faculty members attended the first planning meeting of Environmental Studies this fall. About nine of them were the area's hard core, the faculty for whom Environmental Studies is the highest teaching priority. Their specialized expertise spans plant physiology, land use planning, architecture, environmental chemistry, geology, marine biology, physics, and mathematics. The rest—a political scientist, a terrestrial ecologist, a biochemist, a second architect among others—were faculty for whom Environmental Studies is a strong secondary interest. They came to contribute their ideas and opinions, to keep in touch with developments, for some of them might end up teaching in the courses listed in the catalog under the Environmental Studies heading. All Evergreen faculty are expected to affiliate themselves with two or three different Specialties; the intent of this policy is to promote communication among the areas, and to help assign faculty where they are most useful. Interdisciplinary team teaching creates special demands for expertise. A course organized around the Northwest salmon fishery problem, for example, requires a marine biologist and someone knowledgeable about the politics and sociology of regulatory agencies. That need may mean that someone whose primary interest is in a Specialty with a political-social focus gets pulled into an Environmental Studies course for a year. Multiple affiliation by faculty means a larger pool of potentially available faculty, and hence greater scope in designing courses, than a single affiliation would allow.

The planning group's task was to select the Environmental Studies offerings for next year 1978-79, from among ideas proposed by the faculty present. Several kinds of information were available to them. The 20-to-1 student-faculty ratio was given. Past experience indicated that 120-160 students were likely to enroll, and that interest had been consistently high in natural history (descriptive field biology and geology), alternative agriculture, intensive field research projects, ornithology, Though enrollment had been somewhat low, case study programs like Applied Environmental Studies had achieved very good results. The physicist had a definite desire to continue teaching a course on energy production and storage systems for a second year. And so on.

Using this information to choose the next year's offerings is not necessarily straightforward. The absence of fixed requirements can impose a tension on planning. Student interests and faculty preferences and professional judgments may differ as to what subjects or approaches should be pursued, and both students and faculty have effective means of expressing themselves. The faculty invent and select the courses; the students are free to enroll or not. If the tension can be resolved by identifying courses interesting to both students and faculty, tremendous benefits accrue in the form of high motivation and cooperation. Especially given full-time courses, the stakes are high. With five years of experience, however, the faculty have become attuned to the situation, and have a number of successful previous models available for emulation. While tension is never absent, there is a general expectation of success.

The planning group met weekly during the six weeks in which curriculum planning is largely concentrated. Informal conversations took place over coffee and in the halls. Two evolutionary processes were at work. Ideas for course offerings were being worked out, merged, or refined in accordance with a group consensus about what was likely to work out well. Simultaneously, tentative staffing assignments were emerging, as faculty worked out what their preferences were—to push ahead with a pet idea, to join a team forming around a colleague's proposal, or simply to be available where needed. The process is uneven and often ambiguous. But by the end, a pattern of courses developed which basically met the constraints of expected enrollment and student interests, available faculty, and facilities. Though similar to that of previous years, it contained some significant modification; more important, it was backed by a substantial consensus among the faculty involved, despite the brevity of the planning period. I will list the results in full because they indicate the kinds of subject matter that are likely to persist in Evergreen's Environmental Studies Specialty Area:

"The Nature of Natural History": natural history with heavy field emphasis taught by a geologist, a zoologist, a botanist; prerequisites: basic zoology, botany, geology; full-time course running all year; 60 students.

"Envitonmental Design": introduction to architecture and planning, taught by two architects; prerequisites: sophomore standing; full-time course running all year; 40 students.

"As You Sow: A Study of the Small Farm": plant and soil science, economic aspects of agriculture; taught by a plant scientist and a land use planner; prerequisites: sophomore standing; full-time starting Winter quarter and continuing through the summer; 40 students.

"Northwest Forests": forest ecology and management; taught by a plant physiologist; prerequisites: junior standing and strong exposure to natural or social sciences; full-time for Fall and Winter quarters; 25 students.

"Applied Environmental Studies": case studies on energy and on decentralized social organizations, taught by physicist and urban planner; prerequisites: a year of college work in the natural or social sciences; full-time all year, 40 students.

Each year from now on, there will be a similar short planning cycle. As things stand now, "Environmental Design" is slated to alternate with a set of three smaller one-quarter courses on advanced topics in physical and social design. Natural history and agriculture in some form will appear annually. So will general ecology and some form of problem or case study offering, though their specific foci will vary considerably depending on the available faculty. Topics with a marine emphasis, oceanography, aquaculture, and the like, will appear under the rubric of Marine Sciences and Crafts, another Specialty Area. All such long-range plans, however, are subject to modification in next year's cycle of planning meetings in which a similar but fresh solution will be worked out based on the faculty preferences, indications of student interest, and lively topics then current.

The final important feature of the curricular structure is a planned periodic review of each Specialty, somewhat on the model of a visiting committee or accreditation review. An internal self-study will be combined with a campus visit and critique by an ad hoc committee of outside academics and professionals, with the aim of maintaining a check on the quality and appropriateness of each Specialty's work.

In operation, of course, a host of lesser technical matters have had to be worked out, involving transcripting, the development of college-level literacy, the provision of highly specialized skills, arrangements for part-time students, and the like. There is no need to review such details here. The picture I am trying to paint is unfamiliar enough without clouding it further with the exceptions and special provisions that become necessary in any complex, ongoing venture.

One can get a glimpse of some general features of the system from this example. The number of courses is very small, but each is ambitious in scope. It is easier for students to go far with a small number of topics than to sample broadly. The degree of collaboration among faculty from different fields is high. The possibility for very erratic or idiosyncratic planning clearly exists, but the discipline provided by student interests and by open discussion among a broad group of faculty acts to prevent it. A measure of predictability has been achieved by working on a two-year cycle, and by identifying certain generic courses; freedom to innovate has been preserved by changing faculty teams yearly or biennially, by leaving exact details of courses open to variation, and by conducting a yearly update, as described, of the entire Specialty curriculum.

For the future, the most certain fact is that Evergreen's education in environmental studies and in all other areas will continue to adapt to the college's circumstances. The partial codification of the college's inductively developed pattern is only two years old. Some on campus fear that it represents a trend toward departments and drastically restricted innovation. While it is too soon to tell, the continued liveliness of the campus argues against any "hardening of the categories." Personally, I believe in addition that American higher education is in too great a state of flux, is subject to too many present challenges for any static system to be viable. Only a college organized to know how its internal resources are changing and to respond adaptively to changing student bodies, funding patterns, regulatory requirements and the like can prosper. Evergreen's unorthodox organization is by no means the only possible approach, but it is one that has proven itself over six years of progressively steadier existence, and that promises to continue to serve the college well.

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ENHANCING COMMUNITY RESOURCES: FLORIDA STATE UNIVERSITY'S ENVIRONMENTAL EDUCATION PROJECT

by David E. LaHart and Rodney F. Allen*

How do you translate the skills and resources of a university into public participation in resource management issues? The Florida State Environmental Education Project has developed a technique for involving faculty, public officials, lay leaders, and inservice teachers in community-based workshops around the state. Topics have included increasing the utilization of a museum, highways and transportation planning, and wildlife conservation. Workshop materials have spun off around the country via ERIC. By "training the trainers," the Project achieves a multiplier effect from modest funding.

"Resident instruction, research, and community service": perhaps the universities of today have the broadest responsibilities ever assigned institutions. The goals identified in early legislation establishing institutions of higher education have remained. Objectives and methods have changed as a society confronting dilemma and disaster turn to universities for help and direction. Environmental education, "total education for a total environment," provides a pivot for change that may redirect universities' dollars and energies.

The Environmental Education Project at Florida State University has directed its energies toward community leaders and inservice teachers in an effort to exploit and enhance community-based environmental education in both formal and non-formal sectors. Dollars from various Federal, state, and private organizations allowed the project to act as an enabler, a catalyst that helped people contribute, and a community react.

Community Leaders Training in Environmental Studies

The project's first effort to exploit the knowledge and resources "out there" developed as a result of funding under Title I of the Higher Education Act. The project was designed to increase community group utilization of the Tallahassee Junior Museum.

The Museum was established in 1962 and provides the community a center of interest in the fields of early Florida's pioneer history and environmental science. While most of the Museum's education programs are youth oriented (in 1975-76, over 30,000 school children visited the

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Museum), the exhibits, wildlife, pioneer farm and nature trails have a tremendous appeal for everyone in the community.

The fifty-two acre site was developed to preserve as much of the natural flora and fauna as possible. The nature trails meander over forty acres of flowers, large oaks provide a canopy of shade, and long boardwalks over a cypress swamp hold a special fascination for visiting hikers. White-tailed deer and wild waterfowl can be spotted in their natural habitat. Small mammals and birds are kept in a small animal compound where they are used for study. Other animals like the white-tailed deer, the Bald Eagle, black bear, and waterfowl are exhibited in large natural habitats which allow them relative freedom. The Museum plans to have most of its animal collections in natural habitats.

The Museum's "Big Bend" pioneer farm is authentic. The buildings were built in the 1880's at Hosford, about forty miles west of Tallahassee. Only the smokehouse and the blacksmith shop were reconstructed and then old materials were used. The farm area is enclosed by a split rail stake-and-rider fence also moved from the original farm site. The farm animals are typical of those found in early Florida barnyards.

The main Museum buildings house changing exhibits on natural science, history, social sciences, art and music. The Natural Science Building features dioramas on birds, a bird-viewing window, and the Museum's collection of live reptiles.

The Tallahassee Junior Museum is a tremendous community educational facility for the Tallahassee area and represents a substantial investment of time and capital by members of the community. At a time when the community is very concerned about environmental quality—demanding increased planning and protective ordinances—the museum offers the place and the resources for expanding community-wide environmental awareness and education.

In essence, two needs came together and provided an opportunity. First, adult community leaders in Tallahassee expressed the need for environmental awareness and education. Few groups and agencies were functioning to provide more than raw information on environmental issues; very few were able to offer an effective educational program to the leaders of groups and agencies or to their participants and clients. At the same time, the Tallahassee Junior Museum was heavily used only in the morning hours when the staff provides educational programs for school children. During these hours, the museum could serve others if groups and agencies could conduct their own programs. In the afternoons and in the after-school hours, the Museum facilities were little used. On weekends the public visits, but without benefit of formal educational programs. With adult community leaders trained in the use of the Museum and with guide/ideabooks designed for those community groups, the use of the Museum could be expanded and the degree of environmental awareness and concern could be heightened.

Many adult leaders were concerned, but needed the educational know-how and techniques for their groups' efforts. In North Florida, growth poses a clear and present danger to the quality of the environment, but also a clear and present opportunity to create the broad-based awareness and sensitivities which sustain persons as they decide upon matters which affect their lives and environmental quality.

The Environmental Education Project was directed toward increasing environmental awareness and toward expanding and broadening the educational uses of the Tallahassee Junior Museum through the cooperation of the Museum staff, a wide variety of community groups, and the Florida State University. To meet this central concern, the Project staff offered community leaders one-week training programs on-site at the Museum which involved participation in environmental education experiences for the community groups which the participants represented.

During the first year of the Project, focus was given to the development of teaching aids and materials specifically designed for community groups. For example, Girl Scout leaders developed environmental learning games and activities for Girl Scouts. The Apalachee Audubon Society developed materials designed to acquaint their membership with wildlife found in North Florida. Thirty-five different "Ways" booklets were developed by community leaders with the help of Project staff. These booklets were distributed by the adult leaders who designed and created the materials. A Florida-wide distribution was made with the cooperation of the Florida Office of Environmental Education in the Department of Education.

Community leaders often gave their booklets to school teachers or other organizations, or kept them for use as family-learning guides. Booklets, or specific units in the booklets, were reprinted by other organizations, several school districts, and even by state agencies. This "spin-off" is still continuing.[1]

The second year of Title I support provided the opportunity to review the material developed the previous year and regroup much of it into more functional packages. Activities developed by Garden Club officers were combined with some materials developed by School Volunteers and by the Florida Association for Children Under Six (FACUS). This made a useful assortment of environmental activities and games for educators who work with children in pre-schools and in the primary grades. In addition, the Project staff conducted over thirty workshops to train new members of the organizations who had participated the first year.

This community environmental project was gratifying in several ways. The project, for example, reached a sizeable body of non-formal educators. The latter make significant impacts on community learning. Now, these educators have environmental knowledge they can convey to their special audiences.

The project also created a tremendous resource through its booklets. These booklets are available at local libraries and throughout the country through the Educational Resources Information Center (ERIC). The ERIC system can provide paper copies and microfiche copies of all the materials for an extremely low cost.

Spin-Offs

The community leaders project produced some very tangible results in terms of curriculum and community involvement with the Tallahassee Junior Museum. It also produced a host of spin-offs that continue the relevance of the project with the community. For example, the project worked with community groups to develop various special interest conferences and meetings. Agencies involved in environmental decision-making requested the project to help develop staff sensitivity to human needs in the many environmental conflicts. The Proceedings of the Conference[2] were distributed throughout Florida and have been reprinted by several of the agencies involved in environmental permitting and enforcement.

Highways and transportation planning caused a great deal of concern and elected community leaders cooperated with the project staff to create a workshop/conference designed to develop citizen input skills for critical highway planning.

Not all citizens have a sense of involvement when it comes to making an impact upon public policy. Remarks from humanists set forth the idea of an open, participatory society, while remarks from practitioners revealed realities. Using transportation planning decisions in Tallahassee, the humanists, practitioners, and conference participants assessed those skills which have been successful in making an impact, those which have not, and those which might be tried. The conference resulted in some findings which will be of interest to educators in environmental and social education for children or adults.[3] A similar conference was conducted at the request of community groups in South Florida.[4]

Environmental education began with nature study, outdoor education, and the conservation education movements. Many environmental concerns are still reflected in the "basics" of environmental education and certainly wildlife and wildlife conservation is a "basic" to environmental education. The project staff cooperated with the Florida Wildlife Federation and developed a program designed to allow citizens to express their feelings about the management of Florida's wildlife resources. With the help of funding from the Florida Endowment for the Humanities, the Project and the Florida Wildlife Federation conducted a state-wide workshop for citizens concerned with the present and future of Florida's wildlife resources. Federal, state, and private conservation interests were able to interchange ideas, notions, and needs under the sanction of a university-sponsored workshop.

Audience response to the workshop format of the program was outstanding. Formal evaluation of the event indicated participants enjoyed the small group sessions with legislators, department heads, and scholars from the humanities. Informal evaluation provided an even more powerful tool for examining the actual impact of the program. "Spin-offs" included a joint meeting of the Boards of Directors of two often opposing conservation organizations, the creation of an essay contest for high school students with wildlife as a theme, and the organization of citizens to politically back the need for increased funding for Florida's endangered and non-game wildlife programs.

Florida State's experiences over the past years have reaffirmed the notion that the real university is out there. Resident instruction, research, community service can be "total education—total environment." Matt Brennan's concept of environmental education is compatible with the role of the university and the structuring of community/university-based programs.

PROJECT DOCUMENTS

Volume I ED 100 734, May, 1975

1. Environmental Sensitivity, Leon Alternative School Staff (All ages)
2. Ten-Minute Mini-Walks, Nims Middle School Teachers (Middle School)
3. Girl Scout Activities, Girl Scout Leaders (Secondary School)
4. Little Folks Activities, Leon County Teachers (Early Childhood)
5. Action Projects, Sierra Club (All ages)
6. Trees, University School Teachers (Elementary School)
7. Humane Education Activities, Leon Humane Society (All ages)
8. Ants, Wakulla County Teachers (Elementary School)
9. Trees, University School Teachers (High School)
10. School Science Activities, Leon County Teachers (Secondary School)

Volume II ED 103 325, July, 1975

1. STEP booklet, Leon and Bay County Teachers (Elementary and High School)
2. K-3 Activities, Florida Association for Children Under Six (Early Childhood)
3. Trees, Blessed Sacrament Teachers (Elementary School)
4. Trout Pond Activities, Girl Scout Leaders and U.S. Forest Service (Handicapped Persons)
5. North Florida Wildlife, Leon County Sportsmen Association (All ages)
6. Handicrafts, Girl Scout Leaders (All ages)

7. Environmental Lifestyles, Environmental Action Group (All ages)
8. Swamp Explorations, Museum Educational Staff (Secondary School-Adult)
9. The (1880's) Pioneer Farm, High School Teachers (High School Social Studies)
10. Wide Games, Girl Scout Leaders (Secondary School-Adult)

Volume III ED 106 213, July, 1975

1. Museum Development, Museum Staff and Board (All ages)
2. Transcending: Humanistic Environmental Education, High School Teachers (Secondary School-Adult)
3. The Animals at the Museum, Natural Bridge School Staff (Middle School)
4. Wildlife Activities, Apalachee Audubon Society (Secondary School-Adult)
5. Creativity, Adult Literacy Council Staff (All ages)
6. Herbs, Tallahassee Garden Clubs (Upper Elementary to Adult)
7. School Volunteer Activities, Leon County School Volunteers (Elementary)
8. Reading Activities, Tallahassee Adult Literacy Council (All ages)
9. Environmental Feelings, Tallahassee Early Childhood Educators (Elementary)
10. Energy Activities, State Energy Agencies (High School)

Volume IV ED 107 579, October, 1975

1. Springtime Tallahassee History, Committee of Springtime Tallahassee (Adult)
2. Community Participation in Environmental Education, High School Teachers (High School)

The project's final reports are also available from ERIC: Final Report: 1974-75 ED 107 583; Final Report: 1975-76 ED 121 671.

NOTES

1. LaHart, David E. and Rodney F. Allen. Community Leaders Training in Environmental Studies. Environmental Education Report, 1976, 4(7):13.

2. Allen, R. F.; D. E. LaHart; and C. R. Tillis. Environment and the Humanities. Office of Environmental Education, Florida Department of Education, Tallahassee, 1976. (ED 127 223)

3. Highways and Humans. A Conference on Transportation Planning and Citizen Input Skills. Florida State University, College of Education, Tallahassee, 1976. (ED 127 219)

4. Sarasota Highways and Humans Conference: Developing Effective Citizen Skills in Transportation Planning. Florida State University, College of Education, Tallahassee, 1976. (ED 139 694)

THE ENVIRONMENTAL PROGRAM AT THE UNIVERSITY OF VERMONT

by Mark B. Lapping*

In Vermont and its state university, a "tradition of the environment" has been strong since the days of George Perkins Marsh. It is perhaps only natural, then, that Vermont has "fully institutionalized" its Environmental Program in terms of budget, facilities, status of the Director, and major. While the Program emphasis is on undergraduate education, there is significant activity in applied research and community outreach. The Vermont Program is particularly distinguished in the ways in which it has been able to energize and draw upon the total resources of the institution—in "connecting minds," as the author puts it. True to its Vermont environment, the public voice of the program is "cautious and reflective rather than rhetorical."

The Environmental Program at the University of Vermont has been well described in a previous publication, Selected Environmental Education Programs in North American High Education.[1] A few of the more significant points made in that paper are noted to aid the reader. The Program was established in 1972 as a major attempt at the University to develop a truly integrated approach to undergraduate education, applied research and community service within a clear environmental focus. The Program is an independent unit within the University of Vermont with the program director reporting directly to the Vice President for Academic Affairs. The Director has full membership on the Academic Council, the University's major policy-making executive committee composed of the President, Vice Presidents, and College Deans. Budgetary support for the Environmental Program is independent and autonomous of other academic units and the program is housed in its own facility. The most critical characteristic of the program, as Director Carl H. Reidel has noted, is that it is "fully institutionalized in terms of budget, facilities, and the position of the Director on the Academic Council."[2]

In the area of undergraduate educational opportunities, the Environmental Program's "major" is recognized as such in each of the major academic units within the University. This did not come through executive fiat, but rather through close consultation within an evolutionary process which saw each of the following academic units approve the program: the College of Agriculture; the College of Arts & Sciences; the College of Education and Social Services; the College of Engineering, Business Administration and Mathematics; the School of Natural Resources; and the School of Home Economics. This

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campus-wide curriculum provides a maximum number of program options and alternatives to students, ranging from any number of traditional departmental majors with an interdisciplinary coordinate major in Environmental Studies, to an individually designed interdisciplinary major in Environmental Studies.

As a "major" in every academic unit within the University, the Environmental Program at the University of Vermont is unique among such programs nationally in its ability to draw upon the total resources of the institution for undergraduate educational pursuits. The options this affords students is reflected in long hours of consultation and advisement between students, faculty, and staff since the myriad of opportunities presented by this institutional framework constantly mandates close coordination, goal determination, and program evaluation.

This structure has provided a mechanism and an impetus for the academic departments within the university to offer new and sometimes innovative courses and programs. Several examples of this bear noting. The College of Education has developed a cooperative program with Environmental Studies in the Area of elementary and secondary options in environmental education; a land use planning program is in the developmental stage in the College of Agriculture; the School of Natural Resources is working cooperatively in the area of environmental interpretation. Similar curricular innovations are occurring elsewhere on the campus within the Arts and Science departments and in the Medical College.

At other times the Environmental Program has been in a position to aid individual faculty members in the development of courses and materials which ultimately move from the "experimental" stage to become standard departmental offerings. This has happened in the fields of art, psychology, natural resources, and medicine. In short, in the area of undergraduate education the Environmental Program stands both as one of the very few university-wide programs and also as a catalyst for other programs and departments within the institution. It has often led the way in interdisciplinary studies which seek to create an atmosphere for the development of "connecting minds." It is a widely recognized model of a highly desirable process of student advisement which is necessitated by the various options and possibilities presented by the program. Finally, the program has become for many an important intellectual haven where new ideas can be expressed and developed. Perhaps this is the most significant contribution the program has been able to make.

This has not taken place without costs nor problems. Like most environmental studies programs elsewhere, suspicions about the credibility and viability of environmental studies existed and probably still exist now that the "environmental movement" has settled-in to become more reflective and less rhetorical. Also, key institutional barriers and constraints to greater coordination and the sharing of faculty and resources do exist. This is perhaps universal during a time of cut-backs and retrenchment. There are also those who still would rather see the Environmental Program as part of a college rather than as a separate university-wide program. Yet, over the years, and on balance, the Environmental Program has clearly enriched the content and quality of the undergraduate educational experience. Associations with other academic units have been developed and are strong. Individuals in other units whose work falls under the broad umbrella of "environmental studies" have found all levels of support through the Environmental Program. There has developed, then, a large range of skills and courses which have come to be a major focus of the University.

The applied research focus of the Environmental Program remains small, limited by faculty size and other commitments, but focused on Vermont's problems. In the past much of the Program's research was in the area of water resources, since the Director of the Program was also the Director of the Vermont Water Resources Research Center. With university reorganization, this latter mission was transferred to the newly-organized School of Natural Resources. In the several years since its establishment, however, the Environmental Program has become deeply involved in applied environmental research efforts which are appropriate to units within a land-grant university, though the program does not receive funds from such traditional land-grant sources as McIntyre-Stennis Funds or Agricultural Experiment Station monies. Very largely funded through outside sources, major efforts in the past have included an analysis of Vermont's transportation system as it relates to settlement and land use patterns, the property tax system as it impacts on local educational services, the Lake Champlain basin area's problems, and other issues. Presently the staff of the Environmental Program conduct funded research projects in such diverse areas as lake level regulation, septage disposal and management, agricultural land preservation policy, and water law. Each of these projects focuses on issues of interest to Vermonters; program staff members have, as part of their mission, a commitment to develop research programs consistent with the solution of real problems.

The public service component of the Environmental Program cannot be separated from its research and teaching thrusts. Clearly, the Program's emphasis on applied research carries it into the public service sector. Program staff members serve in advisory and consulting positions to any number of governmental agencies and on the national, regional, and state level. Additionally, they are often called upon to deliver testimony before governmental committees and agencies. Likewise participation in the activities of major professional groups is also high, and this too has important "public" impacts. One cannot separate this level of participation from context. For one thing, Vermont is a small state which affords a high degree of "visibility" to environmentalists given the state's almost unique natural resource and environmental commitments. However, it is all too easy to lose one's credibility with Vermonters if errors are made. Thus, the Environmental Program has maintained and enhanced its level of credibility with a cautious and rigorous research and public service emphasis.

Public service needs have also brought about a high level of activity in the Continuing Education college of the University. The Program has offered a variety of courses through the Evening Division and the Summer Session taught primarily by community professionals (e.g., environmental law, policy, design, historic preservation, planning, education, interpretation, psychology, community organization). Work with the Vermont Educational Television system has also been a Program activity (e.g., "Man and Environment" series; documentaries on energy, trainsportation, land use; and a number of interview and audience participation programs). Special conferences and workshops have been conducted both independently and jointly with other units within and outside of the University. In an effort to expand the "public service" component of the Program, work has begun with the Cooperative Extension Service on several projects.

In any evaluation of the Environmental Program at the University of Vermont, mention must be made of Vermont itself. This is a state with a strong environmental tradition and a future closely tied to its resource base. As such there has evolved a "tradition of the environment" here in Vermont which has been a significant asset to the Program. Likewise, such a tradition has existed here at the University, at least since the days of George Perkins Marsh. Both aspects have enhanced the Environmental Program and in its turn the Program has come to be recognized as an important asset of the State of Vermont.

In terms of the future, the Program will maintain its three emphasis thrusts in undergraduate education, research of an applied nature, and public service. Since student academic programs are either individually designed or related to a variety of other academic units, each new class presents a wide and sometimes unique variety of interests and needs. Likewise, research and public service will be flexible in an effort to remain relevant and allow the program to have some level of impact upon changing problems. Perhaps the only danger with such an approach, at least in terms of research and public service, is the tendency for a program to move in the direction where the dollars are. All too often the grants become the "tail which wags the dog." Criteria for determining priorities must be constantly re-evaluated to guarantee that the basic mission of the Program -- to be a cataylst within the community -- is met.

NOTES

1. Arden L. Pratt, ed. Selected Environmental Education Programs in North American High Education. (National Association for Environmental Education, 1974.)

2. Carl H. Reidel. "The Environmental Program," in p. 90, Selected Environmental Education Programs in North American High Education.

ENERGY AND RESOURCES GROUP AT UNIVERSITY OF CALIFORNIA—BERKELEY: POTENTIALITIES AND PROBLEMS

by Allan J. Lichtenberg*

Here is a remarkable case history of the aggravating problems and alluring potentialities inherent in organizing and maintaining an interdisciplinary graduate program in a university world unattuned to fostering such developments, yet with the basic human resources for "that old college try." Based on the premise that "it is necessary not only to examine the pieces of the energy situation, but also to comprehend how the pieces fit together," the Energy and Resources Group (ERG) two-year M.S. and M.A. degree programs at the University of California, Berkeley, admit students with degrees in either the natural sciences broadly defined or the social sciences broadly defined, and then buttress the former with an improved social perspective and the latter with better technical understanding. Both groups pool their learning in group seminars and collaborative research projects. The ERG Ph.D. is a research degree requiring at least another year of work beyond the master's. While problems persist in assigning funds, space, and faculty to the Group, a new Associate Vice Chancellor has been appointed to help administer such "irregular" programs at Berkeley. His main concern lies in how better to match the concept of problem-oriented and innovative curricula to the more traditional administrative structure of the university.

Energy and Resources as a Focus of Inquiry

Although the central role played by energy in the biosphere, in the evolution of human societies, and in contemporary industrial economics has long been recognized by students of these fields, only recently have issues related to energy and resources become of general public concern. The particular factors that governed the energy shortages of 1973 and 1974 may change rather quickly, but the underlying ingredients of a deeper energy dilemma are more lasting. These ingredients include energy's clashing roles as a cornerstone of economics prosperity and a dominant component of environmental disruption, the intrinsic technical difficulty of maintaining a fixed percentage annual increase in

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consumption as the level already achieved increases and the international political ramifications of resource allocation in a world of limited resources and rapidly evolving economic aspirations.

These circumstances underline the importance of disciplinary research and teaching in such fields as the engineering disciplines, economics, public health, and political science, fields in which there exist long-standing commitments at the University of California, Berkeley. At the same time, the thoroughness and the subtlety with which energy is woven into the fabric of modern society, and the increasing degree to which different elements of the problems are now interacting with each other, suggest the need for integrative as well as component-focused efforts at understanding. It is necessary not only to examine the pieces of the energy situation, but also to comprehend how the pieces fit together.

This latter, integrative kind of effort is an intrinsically interdisciplinary enterprise. To succeed, it must draw on the competence of experts in many fields, establish fruitful communication among these experts, and provide a framework for continuing interchange between those interested in single elements of the energy problem and those seeking to understand the interaction of many elements. The difficulties are considerable, but the rewards can be great: teaching that relates specific skills of the student to the broader societal context; possibilities for interdisciplinary research as well as the identification of useful new directions for within-discipline research; and improvement of the University's capability to perform public-service functions in an area where both the complexity of the issues and the demands for assistance are rapidly increasing.

Difficulties in Developing an Interdisciplinary Teaching and Research Activity

There are many difficulties in developing an interdisciplinary program at a university. Universities are traditionally organized along disciplinary lines. All of the resources of the University, e.g., faculty and support, are channeled through the departments. Faculty are loathe to devote too much time to activities outside of the department structure. Reallocation of funds is particularly difficult in a period of no growth, which academic institutions are experiencing today. There is also a general feeling on the part of faculty that problem solving, which is the essence of interdisciplinary research, is not academically pure. Surprisingly, this attitude seems to be most prevalent among engineering departments. These factors combine to make faculty reluctant to undertake the development of interdisciplinary courses.

Research and graduate student support encounter a similar set of difficulties. Government research sponsoring agencies have traditionally been set up to deal with specific disciplines. Compounding the difficulty is a general feeling within the government that problem-oriented research should deal with crises, and consequently should have a very short time scale. This is not well matched to the normal time scale of graduate student research, and it is therefore difficult to obtain normal graduate student support. We will return to these problems in the final section.

Our Road to the Establishment of an Interdisciplinary Program

Our first concern was in understanding the nature of the energy problem. Were the problems mainly technological in nature, as were, for example, the fusion problems we had been studying, or were they fundamentally interdisciplinary? To answer this question we instituted a seminar, with the unusual title "The Ecology of Power Production and Utilization", in the 1969-1970 academic year. We explored the broad range of energy questions dealing with resources, conversion, utilization, and environmental effects. Our general conclusion was that energy problems were fundamentally interdisciplinary, and furthermore, would become a serious societal problem over the coming decade. We concluded that they justified the development of new educational forms to study them, involving both natural and social sciences.

In 1971-1972 a faculty committee, under the chairmanship of Professor C.K. Birdsall, was formed to explore the institutional problems involved for the campus to engage in interdisciplinary energy studies. Members of the committee came from a wide range of departments in engineering, the natural sciences, and the social sciences. The committee was advisory to the chancellor in formulating campus energy policy. After a year of informal discussions and seminars three decisions were made: to work for the establishment of a degree-granting graduate group, to press forward with an Energy and Resources Program to perform a variety of interdisciplinary energy related activities, and to acquire a small faculty, independent of departments. Modest resources were made available for these activities from discretionary funds within the chancellor's office, and the Energy and Resources Program was begun in 1973.

The Energy and Resources Program took on a number of activities. A new faculty member, John Holdren, was recruited to be associated with the program and to develop interdisciplinary courses. He developed and taught three new courses at the lower division, upper division, and graduate level during the first year (1973-74). In addition to the academic program, other functions and facilities developed. An energy information center and reading room was established, beginning a collection of periodicals, books, reports and government documents in the energy field. A half-time "energy specialist" assisted the campus community, public agencies, and individual members of the public with their energy-related information needs. Current information on campus energy-related courses and research were gathered, together with information on outside fellowships and job opportunities. A weekly newsletter informed the campus community of energy-related activities. Various special lecture series, symposia, and short courses were presented under joint sponsorship with other campus groups. Dr. M. King Hubbert was sponsored by the program as Regents Professor, for Spring 1973; he gave a series of lectures on the topic "Energy and Man".

During the same year that the Energy and Resources Committee supervised the developing program, its primary additional task was to formulate a proposal for a degree-granting graduate group. A detailed plan was developed and presented in March 1974 to the University for approval. The various levels of approvals by faculty committees and administration, both at the campus and university levels, proceeded over more than a year, with final approval of all degree programs, M.S., M.A., and Ph.D., obtained by Fall 1975. The first M.S. candidates were admitted in Spring 1975, with the 1975-1976 academic year being the first regular year of operation. A campuswide announcement of the formation of the Group, plus personal contacts, resulted in a broadly interdisciplinary faculty membership of over 40 members from 23 departments. A single page announcement of the degree program was distributed to other universities.

The path to approval of the Group was both slow and difficult. Faculty committees had to be convinced of the educational worth of this type of integrative, problem-oriented, activity. The administration had to wrestle with new forms, for which the chain of command would be outside of the regular channels. Problems persist in assigning funds, space, and faculty to the Group. As a result of these difficulties, which the Energy and Resources Group has not been alone in experiencing, the university appointed an Associate Vice Chancellor to handle the innovative and interdisciplinary programs for the Berkeley campus. The Energy and Resources Group now reports directly to this administrative officer for budget and space allocations as well as for requests for faculty positions.

Energy and Resources Group (ERG) Degree Program

The following description of the requirements of the degree program is extracted from a general information brochure of the ERG program. It describes the main features and requirements of the two year M.S. and M.A. degrees and the Ph.D. degree granted by the Energy and Resources Group.

1. Specific fields of emphasis

The ERG graduate program admits students having bachelors and/or masters degrees from the natural sciences (including but not limited to the areas of biology, chemistry, engineering, geology and geophysics, physics, public health) and the social sciences (including but not limited to the areas of business administration, economics, geography, law, political science, public policy). The M.S. and M.A. degree programs entail two tracks in course work for those coming from different backgrounds, with both tracks encompassing intensive and substantial work in the scientific, technical and social problems related to the production and use of energy. The students entering with natural science backgrounds (M.S. program) will be guided to courses giving them an improved social perspective and those from social science

(M.A. program) to courses giving better technical understanding. Both groups will pool their learning in the group seminar and possibly in collaborative research or projects at the masters level. The basic fields of interest applicable to the ERG degree programs are energy resources, conversion, environment, energy systems and use (including conservation), and policy.

2. Requirements for the master's degree, two-year program

The unit requirements normally total 60 (with 3-4 units equal to a one-quarter course) and are normally divided up as follows:

a. 24 units within either the natural or social science area, including 18 units of graduate work, within a given discipline or unified area of study as defined in consultation with ERG advising (see below);

b. 18 units within the complementary energy and resources track, of which 9 units must be graduate level;

c. 6 units of interdisciplinary or synthesizing courses in the ERG program (chosen from Energy and Resources 100, Environmental Studies 102, Engineering 160, Engineering 260);

d. 6 units of ERG seminar;

e. 6 units of research pursuing a master's research project and resulting in a paper; the paper in lieu of the comprehensive examination.

So that there is no ambiguity, requirement (a) is for, say, an engineer to continue in engineering, and (perhaps) related environmental aspects, adding (b) with focus either on economics or policy; similarly, say, a political scientist would complete (a) in political or other social sciences and (b) in the natural sciences. Advance preparation may be used to reduce the 60-unit requirement.

3. Requirements for the Ph.D. degree

Normal entry into the doctoral program will be by completion of the Energy and Resources M.A. or M.S. Students who have obtained a disciplinary master's degree elsewhere and who wish to enter directly into the doctoral program must meet the basic requirements of the Energy and Resources M.A. or M.S., except for the master's research project.

Each student will design his/her doctoral program in consultation with an interdisciplinary guidance committee appointed by ERG. While there are no additional unit requirements beyond those required for the M.A. or M.S. in Energy and Resources, it is expected that most students will choose to go deeper into both natural and social science courses as demanded by preparation for their research activity. (The minimum residence requirement for the Ph.D. is set by Senate regulation at two years, so that ERG doctoral students would be required to complete at least six quarters of academic residence to be eligible for the degree). The Group Advisor gives final Group approval.

In addition to the above preparation, the following requirements must be satisfied for completion of the doctorate:

a. Each student's progress is to be evaluated at the end of the first doctoral year; this will normally take the form of a preliminary examination;

b. Completion of the foreign language requirement;

c. Completion of the doctoral qualifying examination;

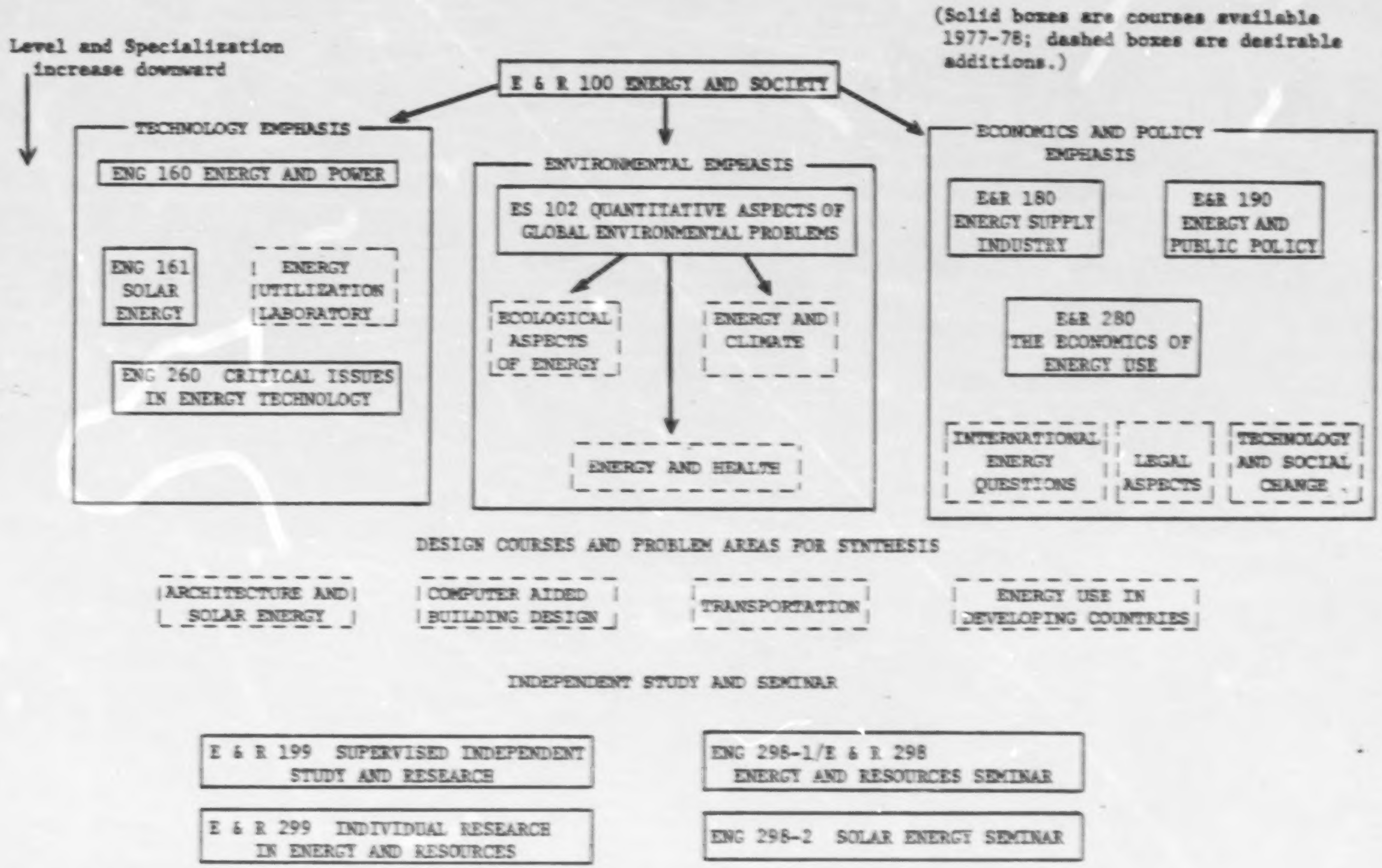
d. Completion of a doctoral dissertation based on research in Energy and Resources.

Potentialities and Problems

1. Academic

Approximately 30 students are enrolled for the 1977-1978 academic year, in the M.S., M.A., and Ph.D. programs. Our first graduating class in Spring 1976, at the end of two full years of operation, was granted three M.S. degrees, four M.A.'s and one Ph.D. Five students took Ph.D. examinations. The academic plan calls for a steady-state of 45 students, more or less equally divided among the three degree categories. We have had many good applicants for the available positions and we anticipate considerable difficulty in holding the number of students down to the targeted figures. The students come from diverse backgrounds, about two-thirds from natural sciences and engineering and the rest from social sciences. There is sufficient shift from the natural sciences to the social sciences that there appears to be no difficulty in keeping the number of M.S. and M.A. degrees about equal. A more serious problem involves the ability of students coming from the social sciences to satisfy the rather rigorous requirements in the natural sciences. This has often required considerable make-up of basic science courses, and consequently very high student motivation.

The core curriculum is only partially developed. The accompanying diagram (Fig.1) illustrates the long range plans for course development together with the courses already available. The core courses are taken by many ERG graduate students, but the majority of the students in the courses are from other disciplines who are taking the courses for general interest. Most of the courses comprising the ERG graduate student's degree requirements are taken in the various disciplinary departments. Each student works out her or his individual program in



(Solid boxes are courses available 1977-78; dashed boxes are desirable additions.)
Level and Specialization increase downward
E & R 100 ENERGY AND SOCIETY
TECHNOLOGY EMPHASIS
ENG 160 ENERGY AND POWER
ENG 161 SOLAR ENERGY
ENERGY UTILIZATION LABORATORY
ENG 260 CRITICAL ISSUES IN ENERGY TECHNOLOGY
ENVIRONMENTAL EMPHASIS
ES 102 QUANTITATIVE ASPECTS OF GLOBAL ENVIRONMENTAL PROBLEMS
ECOLOGICAL ASPECTS OF ENERGY
ENERGY AND CLIMATE
ENERGY AND HEALTH
ECONOMICS AND POLICY EMPHASIS
E&R 180 ENERGY SUPPLY INDUSTRY
E&R 190 ENERGY AND PUBLIC POLICY
E&R 280 THE ECONOMICS OF ENERGY USE
INTERNATIONAL ENERGY QUESTIONS
LEGAL ASPECTS
TECHNOLOGY AND SOCIAL CHANGE
DESIGN COURSES AND PROBLEM AREAS FOR SYNTHESIS
ARCHITECTURE AND SOLAR ENERGY
COMPUTER AIDED BUILDING DESIGN
TRANSPORTATION
ENERGY USE IN DEVELOPING COUNTRIES
INDEPENDENT STUDY AND SEMINAR
E & R 199 SUPERVISED INDEPENDENT STUDY AND RESEARCH
E & R 299 INDIVIDUAL RESEARCH IN ENERGY AND RESOURCES
ENG 298-1/E & R 298 ENERGY AND RESOURCES SEMINAR
ENG 298-2 SOLAR ENERGY SEMINAR

Figure 1.--Interdisciplinary Courses in the Energy and Resources Program/Graduate Group

consultation with an advisor from each track. This lengthy process has already put strains on the two Graduate Advisors, who are the full-time faculty within the program. A system devised to share this duty among the associated faculty has not yet been fully implemented. The proposed course development will clearly require new full-time faculty within the Group, or considerably more participation of the Group faculty within departments. The former is difficult at a time when the university is not growing, as new positions must be transferred from established units. The latter also presents difficulties, as faculty in other departments are hesitant to make too large a commitment outside of their main professional channel of advancement. The main involvement of most of the large group of associated faculty will be in supervising graduate student research.

Another problem is that of space. The initial space for the program housed the library-reading room, office for a faculty member and the energy specialist, and secretarial space. After two years this space was already inadequate, and a move to larger quarters was made, including an office for our second regular faculty position, visiting faculty, a student room, and a second library room housing a special collection. Despite this move, only recently completed, space for the coming year is already inadequate. Although we do not foresee exponential growth with a two-year doubling time to continue for long, space limitations can severely restrict the program development.

2. Research and Funding

As stated in the first section, the reason for the Energy and Resources Group's existence is the nature and importance of the societal problems involved. Yet the traditional funding sources are not set up to handle these interdisciplinary problems. The newer funding sources, which are problem-oriented, such as FEA, NSF-RANN, and the State Energy Commissions, on the other hand, want crash solutions to immediate problems. Their time scales are usually months, rather than the two or more years usually associated with graduate student research. This mismatch has prevented the establishment of longer term interdisciplinary research involving graduate students, and also helps perpetuate the feeling among established departments that interdisciplinary research may not be research at all.

With the establishment of ERDA there was hope that this situation would change, but so far these hopes have not been realized. At the present time there are no direct channels into sources of funds within ERDA/DOE dedicated to interdisciplinary research. Furthermore, the money that is available for activities such as energy conservation, which is inherently interdisciplinary, is either geared toward large technological projects or toward short-term studies, again inappropriate for graduate student research.

The result of this mismatch between normal university practice and funding sources has been lack of graduate student integration in the research process. Despite this difficulty, most of our graduate students have found support to allow them to continue their studies. The projects, however, have tended to be short-term or unrelated to their primary interests, and thus not efficient, either for training or for solving research problems. The expansion of the Energy and Environment Division of the Lawrence Berkeley Laboratory has led to an increase in longer-term energy projects, some of them interdisciplinary in character. This has been a major source of graduate student research and support. Recently, experimental programs, involving ERDA funding, of an avowedly interdisciplinary nature, have been begun, but their success and continuity of longer range funding has not yet been assured.

Summary

Our long road to the establishment of an interdisciplinary program for the study of Energy and Resources seems to have been worth the journey. We are convinced of the importance of this type of endeavor, and our own conviction has been reinforced by outside interest in our development. The formation of a degree-granting Graduate Group, and the subsequent influx of spirited graduate students, are the mainsprings of the program. The large number of interested faculty are expected to become increasingly involved as the graduate students begin their thesis research. The perennial problems of money and space are, of course, with us, as we are a rapidly growing segment of an established institution. These problems are somewhat intensified by the fact that the institution, itself, is not growing. A serious problem is that of research funding, with the main concern being how to better match the concept of problem-oriented research in the funding agencies with the mode of research best carried on at the university.

LEARNING THROUGH TEACHING: THE UCLA INNER-CITY ENVIRONMENTAL EDUCATION PROJECT

by Mark R. Lipschutz*

At this time not so much a program in place as an experimental project, this University of California-Los Angeles venture rates a place in this book as representative of a novel approach to combining undergraduate experiential education with professional training with public service—all under the mission of injecting environmental considerations into the curricula of urban, cross-cultural, low-income public schools. As the author indicates, it is not easy to identify promising juniors or seniors, intrigue school administrators, recruit willing teachers, or marshal university resources, but, as he says, "if we fail it will not be for lack of trying." Since writing this article, the author has been notified that the project has been funded for a second year.

The UCLA Inner City Environmental Education project tests the hypothesis that the resources of the university can address the environmental needs of the low-income community, using the public school system to provide linkage. The project was born of both the higher and the more immediate concerns of its principal sponsors. The former category included a commitment to pursue the least acknowledged of the University of California's stated goals -- public service. To organize and assemble the University's aggregate knowledge of the urban landscape and deliver it in usable form to those parts of Los Angeles which suffer worst the environmental consequences of man's past actions was truly an exciting idea to us. However, the primary mission of the UCLA Office of Experimental Educational Programs, which initiated the project, was not environmental education; it was and remains undergraduate experiential (i.e., field experience) education. We saw in the project a means of combining public service and experiential education by training both secondary school teachers and UCLA students as environmental educators in low-income schools.

The timing and focus of the project also made it appealing to one of its eventual leaders, Dr. Christopher Salter, Associate Professor of

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Geography. A respected China geographer, Dr. Salter was experiencing some frustration arising from the impossibility of doing fieldwork in mainland China. He viewed the project as an opportunity to refocus on the American scene. The project had further appeal because of Dr. Salter's commitment to undergraduate education. One of the most popular teachers in his department, he has been a leader in matters concerning undergraduate teaching on the campus. A link was thus formed by Dr. Salter, Dean Jane Permaul of Experimental Educational Programs, and Dr. Harry Silberman of the School of Education to sponsor the project. Dr. Silberman, one of the designers of the National Institute of Education and a specialist in educational technology, agreed to oversee the project's evaluation.

While our primary concern was to deliver meaningful environmental education to inner-city Los Angeles in a format involving UCLA undergraduates, we established secondary objectives as well. These include:

1. The development of a generalizable model demonstrating a means of articulation between the urban university, with its wealth of educational resources, and the urban community, which has both the need and the right to tap those resources.

2. The development of environmental educational materials focused on urban Los Angeles, which would be useful not only to teachers participating in the project, but to any teacher in metropolitan Los Angeles wishing to introduce the subject. These materials could further be used as a model for materials development in other large urban centers.

3. Local school districts' recognition of the project's merit, assuming its success, and their active measures to promote the institutionalization of environmental education teacher training in this or a modified form.

The project as proposed was submitted both to the United States Office of Education, Office of Environmental Education, and to the California State Department of Education Environmental License Plate fund. The latter serves as the depository for revenues accrued from personalized license plates, which California motorists may order for a $25 surchage. Much to our gratification, both agencies agreed to fund the proposal, which began operation in spring of 1977. It is scheduled to terminate in summer of 1978.

Description

The project as originally designed called for twenty teachers from inner-city schools in Los Angeles County, and forty UCLA juniors and seniors, to participate in a six-week summer institute co-led by Dr. Salter and by Dr. William Lloyd, whom we borrowed from the University of California, Riverside. Each teacher would team up with two students, and the teams, after completing the institute, would implement environmental education mini-courses in the teachers' classes during the 1977 - 78 school year. Each mini-course would be specifically tailored to the community served by the teacher's school; all would be structured so that the high school pupils would devise locally-relevant community environmental education projects which could be presented to the community. At this writing (Autumn 1977) the summer institute has been completed and the teams are beginning to introduce environmental education in the classes.

As the project has unfolded we have found that it has required little modification. Perhaps the most major change concerns the use of the term "inner-city" to describe the schools in which we operate. With one exception, the schools in which we are operating have large minority populations, and most of them are located in low-income communities. However, some of the schools, including some of the high-minority ones, are clearly not "inner-city." In any case, the term "inner-city" is an elusive one in Los Angeles; the word "urban" seems more appropriate to describe the orientation of the project.

A second modification relates to the mini-course format. Although some teachers are using mini-courses to implement environmental education, flexibility has been the key to operationalizing this project, and where other formats have lent themselves better to an individual teacher's situation, they have been readily adopted.

A third modification is the result of attrition. We originally accepted twenty-one teachers and thirty-eight UCLA students into the program. Because a number of participants have left (either at their instigation or ours), we are currently operating with 16 teachers and 23 students.

Participants

Except for a few exclusively upper income districts, every school district in Los Angeles county was invited to participate. The participants selected represented the Los Angeles, Compton, and Paramount Unified School Districts. In addition, we accepted one teacher from the Las Virgenes District, which is clearly a higher-income area of Los Angeles. We can only say that it is to that teacher's credit that she talked herself into the project.

Recruitment of participant teachers proved to be the biggest obstacle in executing the project. When the project was envisioned, we felt that the opportunities for teachers to earn up to twelve units of geography credit, applicable toward in-service training for promotional considerations, would be ample inducement. We soon discovered otherwise. We learned quickly that in the Los Angeles school district, to take the largest, the average age of a school teacher is now 48 (it is 54 if only contract teachers are counted). The great majority of teachers had already acquired all the in-service credits they had intended to get. Furthermore, the project conflicted with summer school teaching, and with Los Angeles property taxes doubling in many areas during this period, it was suddenly understandable that many teachers would prefer to be in the classroom augmenting their regular salary. Nevertheless, we remain astounded that in an area the size of metropolitan Los Angeles, despite intensive recruitment efforts that involved mailings, phone conversations with scores of principals, newsletter publicity, attendance at faculty meetings, and personal visits, we never had more than thirty applications for the twenty positions.

On the positive side, the twenty teachers we did pick are a highly motivated, enthusiastic group. They are relatively young, and come from a wide variety of disciplines, including the natural and social sciences and the humanities. As much as we have turned them on to urban environmental education, they have reinforced our enthusiasm for the project, and our belief in the success of its mission.

The UCLA students are a mixed group. They were recruited via class announcements, campus newspaper ads, word of mouth, and, because of our desire to include minority students, the assistance of the UCLA Academic Advancement Program. Junior or senior standing was required. Each of the seventy applicants was interviewed personally, and selection was based largely on academic standing, past interest in environmental or community problems, maturity, and motivation. The thirty-eight students who were selected represented more than a dozen majors, most races, and the entire range of socio-economic backgrounds.

At the end of the program our information about each student will be run through some fairly sophisticated analysis to help us determine the characteristics of those who performed best. Although it is too early to make judgements, the staff are quite confident that the best performers will be those students with experience in "the community" rather than those with Woodsy Owl patches on their Pendleton jackets.

The Team Approach

The concept of a summer institute to train secondary school teachers is not new. The National Science Foundation and the National Endowment for the Humanities, to name two agencies, have been sponsoring such programs for years. However, it was our strong feeling that such programs have only limited effectiveness without a specific curriculum modification approach and a follow-up phase. The excitement and enthusiasm generated during the assembly of a group of teachers with common interests, led by a group of committed, knowledgeable faculty, nevertheless fades fast when the teachers return to the reality of the urban classroom.

One approach to this problem is to design a project calling for continued contact between teachers and project staff during the school year. But this too has limitations, since project staff tend to be removed from the classroom experience in these situations. Our idea of using UCLA students as teaching assistants seemed to provide an innovative solution to the problem. The students would offer a number of advantages to the project, including a sense of enthusiasm and a perhaps refreshing naivete, which can sometimes renew a teacher who has taken his or her first steps down the short path of jaded frustration. Further, they would actually assume some classroom responsibilities, a welcome inducement to any teacher. Third, they would increase the chance for environmental education modifications to be carried out throughout the entire school year, since by prior understanding this was the agreement by which teachers entered the project. Fourth, they provided the best opportunity for project staff to gain an entry into the classroom, since, because the students were receiving geography credit for their participation, project staff had a clear responsibility to monitor their performance and provide guidance.

The teams, each consisting of one teacher and two students, were formed during the first week of the institute. Each pairing represented our best attempt to match or complement strengths and weaknesses based on the little we knew about each participant at that point. It was with great trepidation that we announced the pairings and, after a few hours of lecture and discussion, gave the team members their first chance to introduce themselves and interact. Project staff were fearful of hearing a deafening silence at that point. Much to our surprise, the room erupted into a cacophony, with teachers and students quickly getting to know each other and then getting down to business. Since then the teams have functioned effectively as units beyond the staff's best expectations. Team members are for the most part respectful of each other's potential for contribution to the total effort, and willing to share and accept responsibility. There have, of course, been some adjustments based upon reassessment of qualities, personality conflicts, and attrition, but for the most part the teams have remained constant.

The Institute

The institute, which ran during the 1977 Summer Session, had an interdisciplinary focus with a geographical emphasis. The material was designed around four themes: (1) Urban settlement, emphasizing the evolution of the urban landscape; (2) the central city; (3) the urban physical environment, emphasizing interactions between urbanization and landforms, water, climate, and vegetation; and (4) the human resources of the city, including such topics as employment, housing, and public health. About a third of the topics were covered by guest lecturers. Some of these were UCLA faculty from appropriate disciplines; others were outside speakers, including a city councilwoman, an educator specializing in inner city concerns, and a well-known journalist.

Each day's lecture was transcribed in outline form and also in summary with an annotated bibliography so that the participants would be able to best take advantage of the materials for use in their own classes.

One day per week the participants went out in the field, either on organized field trips or in team groupings, exploring the neighborhoods in which their schools were located. During these trips, they were guided by special "activity cards" which had been especially prepared for the project by the project coordinator, Lucy Blackmar, and urban planner David Alpaugh. The cards, each designed around a particular theme, gave the teams ideas on data that could be gathered from their own communities.

Our main concern in the institute was to deliver materials that could actually be used in the classroom rather than to devote all our time to background and theory. To symbolize this commitment, we developed the phrase "Monday morning, 8 a.m." to keep teachers and UCLA students aware that soon after the institute ended they would be facing their students; they needed more than background in order to introduce environmental education. Therefore, a great deal of institute effort was devoted to the production of curricular materials for use in the classrooms. Participants were required to develop a variety of curriculum and mini-course outlines tying their institute experiences directly to the eventual use they would make of them. The teachers, moreover, were required to develop lesson plans for the environmental education component they would be presenting to their classes. The specific nature of their plans depended on the kind of course in which they would be incorporated--science, social studies, humanities, and, in a few cases, environmental education *per se*. The capstone of these efforts took place during the last week of the institute, which was entirely devoted to the development and discussion of materials linked to specific teaching assignments for the forthcoming year.

Participating teachers received eight units of graduate geography credit from the University Extension. They could optionally receive four additional credits for producing more detailed curriculum plans for their classes. UCLA students received eight units of upper division geography credit. They will receive an additional four units of credit for each quarter of work in the schools.

Evaluation

Evaluation of the project is in two stages: a highly informal formative evaluation conducted by project staff, in which the continuing pragmatic decisions that must be constantly made are considered jointly by staff against the backdrop of project goals and objectives; and a much more formal summative evaluation managed by co-principal investigator, Barry Silberman. The summative evaluation will rely heavily on student and teacher documentation of the current activities, gathered in part from weekly record and reflection logs that are being maintained by participants. This log format, developed especially for experiential programs, asks the participant to record what he or she learned that week, and to reflect on those learning experiences. Each week's activities are value-rated on a scale of 1-5. Besides providing a longitudinal view of an individual participant's progress, these logs give tremendous insight into the kinds and stages of learning taking place when the various learning components are identified, abstracted, and broken down into a matrix of learning categories.

Of course, the results of the summative evaluation are not available now. Meanwhile, we have taken a look at the summer institute, scoring and ranking nine of its pedagogical components. This information has been highly useful to us both in assessing the overall value of the institute, and in examining its workings in light of possible repetition of the project.

Impact

On one level of scale, the purposes of the program are to bring environmental education into the classrooms of the sixteen participating teachers and give them materials to make their presentations more effective. However, we feel it vital to enlarge this scale to include more teachers, students, and classrooms. This goal will have been partially accomplished by designing the institute workbook to make it useful to any secondary school teacher in Los Angeles county wishing to introduce environmental education. Beyond this, however, we are interested in convincing the participating school districts to encourage and provide appropriate support for environmental education in the classroom. In our opinion, this means school district support for continuation of the project (possibly with some minor or even major modifications), and distribution of materials throughout the respective school districts.

The key here is the participation and support of the Los Angeles Unified School District, which is one of the biggest in the United States. The problems we are facing are two: trying to get the attention of anyone in the district, which is totally preoccupied with the question of integration, and finding a way to broaden our appeal to teachers. Regarding the former, our experiences in dealing with the district are illustrative.

After securing the endorsement of the Los Angeles School District at the onset of the project, we found that passive cooperation was the best we could expect. We were particularly anxious to enlist the aid of the district when we ran into recruitment problems. Our attempts to work through the Office of the Assistant Superintendent in charge of Title One programs, to whom we had been referred, were rebuffed. We were told that the Title One Coordinators at each of the schools were too busy to help us. Once the program was underway, we approached the Associate Superintendent in charge of Instruction, describing the program and inquiring whether there might be in-service training funds available to continue it after this year. The superintendent suggested to us that the best way to interest the district in the project was to tie it to their immediate need to produce a plan for the new magnet school concept which is part of the district's integration efforts. The message from the district is clear; while it wishes us no malice, environmental education is clearly not at the top of the list of district priorities. This is not to imply that we have given up—merely that we will change our tactics and abandon the idea of simply trying to sell the program on its merits.

The second problem, that of teacher interest, has not been solved in our minds. Assuming that recruitment publicity for the current program was adequate, it appears that it is necessary to increase the incentives for teachers to participate. Perhaps the National Endowment for the Humanities and other agencies have already discovered this, for a number of them pay stipends in the summer programs they sponsor.

Does this mean that the project, like so many models or demonstrations, is destined for limited impact and imminent extinction? Not if we can help it. We are working to continue the project a second year, this time focusing on elementary school teachers and the development of appropriate curricular materials. Indications are that elementary school teachers will be considerably easier to recruit. We are applying for refunding from various granting agencies, and will continue to work to secure support from participating school districts. It is too early to tell whether we will ultimately succeed in institutionalizing the project, but if we fail it will not be for lack of trying. Meanwhile, the project is bringing good environmental education to urban schools that very much need it.

ENVIRONMENTAL STUDIES AT COLORADO STATE UNIVERSITY

by Charles L. Mahoney*

Environmental studies options at all academic levels are many and varied at Fort Collins, befitting the long and distinguished track record of its School of Forestry and Natural Resources. On the one hand there are the relatively traditional majors in forest, range, wildlife, fisheries, recreation, and water resources management. Then there are somewhat newer programs in conservation education, environmental interpretation, environmental health, and general environmental studies. There is a common course in environmental conservation. The CSU curricula benefit considerably from close cooperation with a variety of natural resources agencies located on or near the campus. A bottomland nature center and a mountain campus provide outdoor laboratories where the emphasis is increasingly on energy and other environmental issues of national concern, and on the active involvement of students in a search for solutions.

"Mind is the Master Power that moulds and makes,
And Man is Mind, and evermore he takes
The tool of Thought, and, shaping what he wills,
Brings forth a thousand joys, a thousand ills:—
He thinks in secret, and it comes to pass:
Environment is but his looking-glass."[1]

The professional natural resource manager of today is a scientist trained in the complex task of managing the nation's forest, range, wildlife, fisheries, recreation, and water resources. More specifically, the extensive forests, shrublands, grasslands, lakes, streams, wildernesses, and wetlands—here collectively termed wildlands—are entrusted to the wildland-resource manager. Wildland-resource management can be considered public service in the highest sense. The forester may never see the forest that he establishes reach maturity, nor harvest the game he fosters nor the fish he

[1] From the book "As A Man Thinketh," by James Allen.

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plants, nor hear the laughter of a user of recreation facility that he has built, but he can take immense personal and professional satisfaction in the knowledge that he is performing a highly worthwhile and necessary service to society.

Training programs for wildland-resource management professions are offered at the College of Forestry and Natural Resources at Colorado State University. The resource management curriculum benefits materially from close cooperation with a variety of natural resource agencies located on or near the campus. Included are the Rocky Mountain Forest and Range Experiment Station, Roosevelt National Forest, Soil Conservation Service, Agricultural Research Service, Colorado State Forest Service, and the Colorado Wildlife Division. In nearby Denver, there are state offices or federal, regional or district headquarters of the U.S. Forest Service, Soil Conservation Service, Bureau of Land Management, Colorado Water Conservation Board, U.S. Geological Survey, state offices of the Colorado Wildlife Division of the State Department of Natural Resources, U.S. Bureau of Sport Fisheries and Wildlife, Bureau of Outdoor Recreation. The headquarters of Rocky Mountain National Park is located at Estes Park, 42 miles from Fort Collins. Cooperative endeavors with these agencies include classroom guest lectures, special seminars, tours of the agency facilities and employment of students.

Training programs for resource management professions are many and varied and it is to be expected that many options are available to the students. Typically, a student might well follow the format shown below.

As a freshman, the student enrolls in the Environmental Conservation course. This course, following the ecological approach, is designed to give insight into the structure and function of ecosystems. A prime objective of the course is to create an understanding of the nature of environmental problems and the opportunities available to wildland-resource managers. He learns early that environmental problems largely revolve around the disruption of ecosystems and that solutions or partial solutions to these problems have to do largely with restoration of proper functioning of the ecosystem. While the the incoming student is generally aware that all is 'not right' with his environment, he has many misconceptions as to why, and even what, is 'not right.' Lectures and illustrated talks attempt to provide a factual basis on which action to improve the environment can be taken. The course may be somewhat unique at this point in that an attempt is made to involve the informed students in bettering their environment by offering some aspects of citizen action.

This writer is of the belief that there exists a wealth of untapped human resources in this country. One segment is the informed students who, given direction, could prove to be the fulcrum necessary to correct many of the environmental ills of the country. All too often, the student simply is not aware of the avenues by means of which his voice can be heard or his ambitions realized. Too frequently, he is not aware of the excellent publications dealing with various aspects of conservation that are available to him well beyond the conclusion of the conservation course. Conservation educators should not neglect this aspect of the student's education.

Following his sophomore year, the student spends five weeks of the summer at the Pingree Park Campus of Colorado State University. The field training experience is ecologically-oriented in the two courses, NR 330 Natural Resources Ecology, and NR 340 Natural Resources Measurements. Intensive studies of the plant and animal communities of the central Rocky Mountains, their extent, economic and ecological importance, and probable future are conducted on site. Communities studies include the high plains grassland, mountain shrub, ponderosa and lodgepole pines, spruce-fir and arctic alpine.

Upper division students may well elect the seminar, NR 492 Environmental Conservation. This seminar explores man's environments and the effects of various resource-use, industrialization, living patterns and transportation trends upon environmental pollution and upon humans. Content is variable but focus is often upon naturally occurring levels, safe standards, and upper tolerance levels of environmental elements or attributes and the issues and technology involved in preventing or ameliorating environmental pollution. Scholars and researchers from different disciplines and resource areas are invited to share in presenting current and pending problems and feasible solutions.

At this juncture of his college career, the student may elect a general course of study in natural resource ecology and management or a specific resource area. Details of the curriculums are included in the Colorado State University General Catalog available from the Office of Admissions and Records, Colorado State University, Fort Collins, Colorado 80523.

Specific programs of environmental study and environmentally-oriented activities are discussed below.

Conservation Education Concentration

This concentration, conducted with Teacher Education, offers a bachelor of science degree and qualification for a teaching certificate in four years. Graduates are qualified to teach biology, ecology, or basic natural resources management in junior or senior high schools. Advisers are assigned from both areas.

Freshmen Year			Credits
BY	110	Principles of Animal Biology	4
BY	120	Principles of Plant Biology	4
C	107, 108	Fundamental Chemistry, Laboratory	5
		or	
C	111, 113	General Chemistry I, II	7
		and	
C	114, 116	General Chemistry Laboratory I, II	2
CO	102	Introduction to Writing	2
M	120	Fundamental Algebra	1
M	121	Algebraic Manipulation	1
M	124	Logarithmic and Exponential Function	1
M	155	Calculus for Biological Scientists I	5
NR	120	Environmental Conservation	3
PE		Required physical education (2 semesters)	2
PH	110	Descriptive Physics	3
		or	
PH	121	General Physics I	5

Sophomore Year			Credits
AG	240	Introductory Soil Science	4
B	223	Plant Classification	3
BY	220	Ecology	3
C	245, 246	Organic and Biological Chemistry, Laboratory	5
CO	202	Intermediate Writing	2
MB	250	General Microbiology	4
PY	100	General Psychology	3
SP	101	Public Speaking	2

Summer Field Training Program, Pingree Park Campus			Credits
NR	330	Natural Resources Ecology	2
NR	340	Natural Resources Measurements	4

Junior Year			Credits
AE	300	Principles of Human Anatomy and Physiology.	4
		and	
AE	301	Human Anatomy Laboratory.	3
		and/or	
AE	302	Laboratory in Principles of Physiology. . .	1
B	440	Plant Physiology.	4
ED	255	Introduction to Education	1
ED	355	Educational Psychology and Exceptionality. .	4
ED	356	Human Relations in the Classroom.	2
ER	140	Physical Geology.	3
ZI	304	General Entomology.	5
		or	
ZI	420	Invertebrate Zoology.	4
ZI	306	The Vertebrates	3
		Humanities.	3
		Social Sciences	3

Senior Year			Credits
AG	330	Principles of Genetics.	3
		or	
ZI	346	Evolution and Heredity.	3
ED	450	General Methods and Materials of Instruction .	4
ED	451	Methods of Teaching Classroom Reading Skills .	1
ED	452	Evaluation of Achievement	2
ED	460	Methods and Materials in Teaching Science . .	3
ED	485	Student Teaching.	8
		Humanities.	3
		Social Sciences	3
Select eight credits:			
ER	304	Principles of Watershed Management.	3
ER	424	Bioclimatology.	3
F	327	Principles of Forest Management	2
FW	307	Fish Management and Natural Resources. . . .	3
FW	360	Principles of Wildlife Management	3
OR	200	Introduction to Recreation Resources. . . .	3
RS	300	Principles of Range Management.	3

Environmental Interpretation Concentration

This concentration prepares students to be naturalists, interpretive officers, and public information specialists for park and resource management agencies. Students may take electives in natural sciences, history, or archaeology.

Freshman Year			Credits
BY	110	Principles of Animal Biology	4
BY	120	Principles of Plant Biology.	4
C	107	Fundamental Chemistry.	4
CO	102	Introduction to Writing.	2
IS	130	Graphic Communication.	2
M	120	Fundamental Algebra.	1
M	121	Algebraic Manipulation	1
M	124	Logarithmic and Exponential Function . .	1
NR	120	Environmental Conservation	3
PE		Required physical education (2 semesters).	2
SP	103	Public Speaking.	3
ST	204	Statistics for Business Students	2

Sophomore Year			Credits
AG	240	Introductory Soil Science.	4
AP	100	Introductory Cultural Anthropology . . .	3
B	223	Plant Classification	3
BY	220	Ecology.	3
CO	202	Intermediate Writing	2
EC	346	Economics of Outdoor Recreation.	3
ER	140	Physical Geology	3
OR	200	Introduction to Recreation Resources . .	3
PY	215	Social Psychology.	3
ZE	135	Ornithology.	3

Summer Field Training Program, Pingree Park Campus			Credits
NR	330	Natural Resources Ecology.	2
NR	340	Natural Resources Measurements	4

Junior Year			Credits
CO	301	Advanced Writing	3
HY	150	U.S. History to 1876	3
NR	320	Natural Resources Policy and Administration	3
OR	302	National Recreation Areas.	3
OR	342	Park Systems Planning I.	3
OR	461	Interpretive Services.	3
S	342	Sociology of Leisure	3

Senior Year			Credits
NR	387	Internship I	1
NR	400	Public Relations in Natural Resources. . . .	3
NR	487C	Internship II-Recreation Resources	Var.
OR	431	Park Management.	3
OR	463	Recreation Program Development	2

Select at least one additional course in each area or concentrate studies in six courses in one of the following areas: sociology, history, archaeology-anthropology, geology-geography, biology-zoology, communication skills.

Environmental Conservation

The course NR 120, Environmental Conservation, serves as the common denominator for further studies in environmental studies. Course description for this course reads as follows:

> Environmental Conservation. 3 credits. F,S,SS. The course attempts to provide honest insight into the environmental problems and opportunities of our day. The student is made aware of the current status of such natural resources as soil, water, air, forests, range, wildlife, fisheries (marine and freshwater), and recreation, as well as the future outlook for these resources. Major environmental concerns, i.e., population, pesticides, litter and solid waste, air and water pollution, are discussed in some detail. Provided with a factual basis for environmental concerns, the student then receives instruction in citizen action—the means available to better our collective environment. The course is aimed at contributing to a knowledgeable and ecologically perceptive citizenry.
>
> NOTE: Open to all students of the University. A course recommended for prospective science and social studies teachers.

NR 120 is developed around two themes. First, the student is informed of the current status of our natural resources—what are they, where are they located, how are they important, what are the particular concerns with the natural resources—and what is the future outlook for these resources. Secondly, several sessions are devoted to current concerns in conservation where population attributes, chemicals in the environment, litter, and solid waste air and water pollution, etc., are discussed in some detail.

The following notes pertain to NR 120:

1. While not identified in the syllabus, guest lecturers from the University, government and industry cover many of the topics listed.

2. The principal instructors have wide experience through personal involvement and observation in conservation matters on the African and South American Continents.

3. Field trips have taken small groups of students enrolled in the course to a number of facilities, including the National Center for Atmospheric Research at Boulder; the Fort St. Vrain Nuclear Plant at Platteville; the largest feedlots in the world, Monfort of Colorado at Greeley; and, locally, the Fort Collins Water and Sewage Treatment Plants.

4. A preliminary edition of a textbook in Natural Resources Conservation is being "tested" with the cooperation from the students enrolled in the course.

5. Twelve audio visual tapes have been produced for use in the course. Much has been learned in the preparation of these tapes, and new ideas will be incorporated in the tapes yet to be produced as funding becomes available.

6. Perhaps most important throughout the course, instruction has attempted to achieve a balance in the environmental attitudes—to combat the "gloom and doom" school and give recognition to vast number of positive actions in the environmental arena today.

The above represents a partial listing of the strengths of the course. Many additional ideas have been tested in the course and failed to produce desired results. Others are in the offing.

Major in Environmental Health

University-trained specialists in environmental health serve society by protecting people from the many health hazards of a complex environment, and work to effect positive environmental changes to benefit all.

Students learn control principles of public health hazards including: air, water, and soil pollutants; communicable diseases; accidents; environmental chemicals; ionizing and nonionizing radiation; and food-borne diseases. They are trained to design and direct programs in health planning, housing quality, toxicology, accident prevention, occupational safety and health, recreational sanitation, insect and rodent control, and noise abatement.

In addition to required on-campus courses, environmental health majors complete a ten-week internship under the joint supervision of CSU and the Colorado Department of Public Health. Upon successful completion of curricular requirements, students receive a bachelor of science degree with a major in environmental health and may be employed by health departments, other government agencies, or industry.

The bachelor of science degree requires 128 credits, with a minimum of 45 credits in upper division.

Freshman Year			Credits
BY	102	Attributes of Living Systems	3
		and	
BY	103	Biology and Organisms.	5
		or	
BY	110	Principles of Animal Biology	4
		and	
BY	120	Principles of Plant Biology.	4
C	111, 113	General Chemistry I, II[1]	7
C	114, 116	General Chemistry Laboratory I, II . . .	2
CO	102	Introduction to Writing.	2
M		Required mathematics (Choose from M 120, 121, 122, 123, 124, 125, 126, 127) . . .	4
PE		Required physical education (2 semesters)	2
SP	101	Public Speaking.	2
		Humanities, Social Sciences.	5

[1] Students with no previous chemistry will take C 105 before C 111 and C 113.

Sophomore Year			Credits
AH	200	Health-The Human Body.	1
C	331, 334	Quantitative Analysis Laboratory	4
C	341, 343	Organic Chemistry I, II.	6
C	344	Organic Chemistry Laboratory	2
CO	202	Intermediate Writing	2
MB	220	Environmental Health	2
MB	250	General Microbiology	4
PH	110	Descriptive Physics.	3
ST	201	General Statistics	3
		Humanities, Social Sciences.	4

Junior Year			Credits
BC	301	Survey of Biochemistry	3
CE	440	Environmental Health Engineering	2
MB	332	Principles of Epidemiology	3
MB	334	Applied Microbiology-Food and Dairy. . .	4
MB	336	Occupational Health and Safety	3
R	400A-C	Radioisotope Techniques.	3
		or	
AN	414	Radioactive Pollution in the Environment .	2
ZE	462	Medical Entomology and Parasitology. . .	5
		Humanities, Social Sciences.	7

Senior Year			Credits
MB	432	Microbiology of Water and Sewage	3
MB	438	Applied Epidemiology	3
MB	446	Environmental Toxicology	4
MB	452	Health Planning and Administration	5
MB	486	Practicum in Environmental Health	2
MB	487	Internship-Environmental Health	10
MB	492	Environmental Health Seminar	1

General Environmental Studies Interdisciplinary Program

The General Environmental Studies Interdisciplinary Program allows students to concentrate electives from a list of approved courses emphasizing environmental issues and alternative problem solutions. Students must complete 20 credits within the program.

The program has four primary objectives: to gain understanding of environmental phenomena; to gain understanding of people's perception of an individual and social reaction to one's environment; to gain understanding of institutional processes (economic, social, and political) for altering people's relationship to their surroundings; and to gain understanding of the interrelationship between students' particular fields of study and their responsibility for, or impact upon, environmental quality and security.

All students are required to take NR 120 and BY 220 as part of their 20 credits of required courses. Other courses are organized in three categories: social sciences-humanities-business; physical sciences-engineering; and biological-agricultural-nutritional-natural resources.

A minimum of 10 credits of the 20 required must be 300-400 level. In addition, students must have at least one course in each of the three areas, exclusive of core courses. Students are also encouraged to enroll for independent study in environmental studies. Independent study may be taken in any CSU academic department, with project approval given by the student's department and environmental studies academic adviser.

Environmental Resources Center

The Environmental Resources Center coordinates research and related training programs dealing with people's development and use of land, water, and atmosphere. Its objectives are to stimulate research on natural resources and related environmental problems, to support training of scientists and engineers for natural resources development and environmental quality control, and to improve information flow between those engaged in research and those in application.

Research under the Water Resources Research Act of 1964 (P.L. 88-379) is administered through the center, providing knowledge needed in management and conservation of Colorado's water resources. Forty faculty members representing 21 disciplines from CSU, the University of Colorado, and the Colorado School of Mines conduct the research. Research training or experience is provided to about fifty graduate students.

ECO Bus

A school bus housing displays of environmental topics and under the sponsorship of Keep Colorado Beautiful regularly travels to schools in the state of Colorado. Displays are maintained and directed to topics of current interests in the environmental area. Presently, two former students trained in Environmental Interpretation and Conservation Education at Colorado State University have responsibility for this traveling exhibit.

Colorado State University Nature Center

The Colorado State University Nature Center comprises approximately 80 acres of land on the Cache La Poudre River southeast of Fort Collins, Colorado. In April 1969 the Poudre R-1 School District, Fort Collins, in cooperation with Colorado State University, received funds under a Title III, ESEA grant to begin planning development of the nature center. This consisted of a curriculum guide for use by teachers, and the master plan for development of the area.

The master plan consists of three parts designed to facilitate orderly development of the area's resources. These are a general development plan, a program plan, and an operations plan. The general development plan recommends use zones and physical developments for the area. The program plan analyzes interpretive and educational elements around which activities will center and recommends how various user groups may use these elements to advantage. The operations plan discusses the administration, management, and protection functions necessary for operation of the center and recommends priorities for developing elements of the master plan.

There are a number of criteria which are characteristic of the Colorado State University Nature Center, and which serve to distinguish it from the general concept of a nature center. The following criteria are important characteristics:

1. University-owned;
2. Interagency cooperation;
3. Environmental conditions which make for excellent opportunities for environmental education;
4. Location which makes it possible to serve the northern Colorado region.

The Nature Center is publicly owned, and is somewhat unique in that it is owned by a university. The type of ownership has important consequences as to administrative setup. Administrative control lies with the College of Forestry and Natural Resources of Colorado State University. This provides excellent opportunities for developing and implementing programs in outdoor education.

Program planning and operation of the center are greatly enhanced by the excellent interagency cooperation which exists. The following organizations have cooperated in the planning and current development of the center and will continue their cooperative efforts in the actual operation of the center:

1. Colorado State University, with the Resource Center coordinating
    a. Department of Recreation Resources, and
    b. Department of Education;
2. Poudre R-1 School District;
3. Other organizations, such as
    a. Boy Scouts of America, and
    b. Army Reserve Unit of Fort Collins.

The center is located in the cottonwood bottomland community, an association of plants and animals that is fast disappearing from the plains areas of Colorado. Disturbances of man are evident at the center which show the delicate balance which exists in nature, and the consequences of disturbing the balance. This provides excellent opportunities for fostering an environmental awareness and for developing programs for environmental education. Some of the more important environmental conditions are the following:

1. Gravel mining adjacent to the center;
2. Irrigation diversion;
3. Sewage treatment plant;
4. Proximity of sheep and cattle feedlots;
5. Industrial pollution;
6. Location in a farming region;
7. Proximity to the Front Range of the Rocky Mountains.

The center is centrally located in Northern Colorado, and is close to major highway access points, making it regional in its effective area of influence. The center is regionally oriented instead of predominantly community oriented.

Pingree Park Mountain Campus

The Campus is situated 55 miles west of Fort Collins in a lodgepole and subalpine forest at an elevation of 9000 feet. Nearby Rocky Mountain National Park and adjacent Roosevelt National Forest make the Pingree Park site an ideal outdoor laboratory for environmental study and research amidst outstanding scenery.

Each summer, the College of Forestry and Natural Resources conducts two separate five-week sessions at Pingree. The first session begins early in June and the second one in mid-July. Opening dates vary slightly from year to year.

The intensive program places more emphasis on practical experience and skills than on textbook theory. At each session two basic courses are taught: NR 330 (Natural Resources Ecology) and NR 340 (Natural Resources Measurements).

NR 330 is a two-credit (semester) course dealing with the ecology of major life zones as well as plant and animal communities of the Rocky Mountains and Great Plains. Two full weeks are devoted to this field and laboratory course.

NR 340 is a four-credit (semester) course in basic measurements of forest, range, watershed, wildlife, outdoor recreation, and fisheries resources and environment. This intensive field course lasts for three weeks and features an overnight wilderness hike in the high country.

The prerequisite for both Pingree courses is BY 220, a basic, three-credit (semester) course in ecology which deals with interrelationships among organisms and their environments. An equivalent may be substituted for non-CSU students.

The facilities range from old and rustic to ultra-modern. Constant improvements in classrooms, cabins, dining halls, and laboratories developed Pingree Park into a modern conference center able to accommodate as many as 300 persons. Yet the beauty of its fragile, pristine environment is protected, as much as possible.

In addition to the summer field training program for forestry and natural resources students, Pingree Park currently serves or has served as the site for a number of environmentally-based programs, including:

Poudre R-1 School District Environmental Science Camp for:

1. A select group of youngsters at the ninth grade level with demonstrated promise in science.
2. Sixth grade students from the city of Fort Collins. All students at this level spend three days in field studies at the Pingree Park campus.

Field Studies programs for students from the State University of New York at Oneonta.
NSF Institutes emphasizing ecology and field studies.
Forest Service field training programs.
Natural Resources Ecology Lab Workshop.
Colorado State Forest Service.
University of Northern Colorado Workshop.
Denver Museum of Natural History.
State Rural Development-Energy Environment Workshop.

Wildlife Habitat Workshop.
Weather Modification.
Russian Botanists.
Science Motivation.
Fishery and Wildlife Services.
Ohio State University Workshop.
North American Foresters.

It is apparent that Pingree Park plays an important role as a site for programs at Colorado State University, where the emphasis is on energy and environmental issues of national concern.

THE CENTER FOR ENVIRONMENT AND ENERGY EDUCATION: UNIVERSITY OF MONTEVALLO, ALABAMA

by Noel McInnis*

With $30,000 in special federal funds and an environmental education leader of national repute, the Alabama Consortium for the Development of Higher Education developed a well-conceived cooperative Center for Environment and Energy Education. For a year the Center had a measurable impact on affiliated colleges and universities, on campus communities, on concerned citizens of diverse backgrounds, and on secondary school personnel. But in the absence of continued federal funding, would the Alabama soil prove to be rocky? The EEE Center for a time was without a full-time director. Then local initiative and resources took up the slack. So the project is now alive, well, and growing at Montevallo.

In June, 1976, the Alabama Consortium for the Development of Higher Education[1] received a $30,000 grant from the Office of Environmental Education for the purpose of (to quote from the grant announcement) "development and refinement of criteria for selection, synthesis and production of environmental education resources for the target groups (K-12) and for the design and testing of the most educationally effective modes of dissemination."

Receipt of this grant climaxed several years of proposal writing by the Consortium's Environmental Education (EE) Committee. Prior to achieving this grant, the Committee's accomplishments included participation of some of its members in the drafting of one of Alabama's state plans for EE and the development of a weekly one-hour TV program entitled "Environment," which is produced at the University of Alabama by Dr. Edward Passerini, a member of the Committee, and broadcast on public television throughout the state with the option of available college credit when viewed in conjunction with a course of study. The Committee has, since its inception, been under the leadership of Dr. J. Ward Tishler, Chairperson of the Department of Health, Physical Education and Recreation, University of Montevallo.

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[*] *Mr. McInnis, who has been active in college and university environmental education for ten years, is the author or editor of several books on EE, most notably You Are An Environment (new edition just published) and What Makes Education Environmental? (co-edited with Don Albrecht). He presently resides in Aspen, Colorado, where he writes prose and poetry, makes music, and conducts workshops on how to actualize self-potential. He continues to consult with EE programs around the country and is a frequent speaker and coffee-house entertainer on college and university campuses. He was Coordinator of the Center reported here during 1976-77.*

Philosophy and Strategy

Upon receipt of the OEE grant, the Committee hired Noel McInnis as Project Coordinator for the grant. The approach taken by the Committee and Project Coordinator to administration of the grant is best understood with reference to two parables, each of which is illustrative of a pitfall that has been the nemesis of many EE programs.

The first parable is a James Thurber fable entitled "The Scotty Who Knew Too Much:"

> Several summers ago there was a Scotty who went to the country for a visit. He decided that all the farm dogs were cowards, because they were afraid of a certain animal that had a white stripe down its back. "You are a pussy-cat and I can lick you," the Scotty said to the farm dog who lived in the house where the Scotty was visiting. "I can lick the little animal with the white stripe, too. Show him to me." "Don't you want to ask any questions about him?" said the farm dog. "Naw," said the Scotty. "*You* ask the questions."
>
> So the farm dog took the Scotty into the woods and showed him the white-striped animal and the Scotty closed in on him, growling and slashing. It was all over in a moment and the Scotty lay on his back. When he came to, the farm dog said "What happened?" "He threw vitriol," said the Scotty, "but he never laid a hand on me."
>
> A few days later the farm dog told the Scotty there was another animal all the farm dogs were afraid of. "Lead me to him," said the Scotty. "I can lick anything that doesn't wear horseshoes." "Don't you want to ask any questions about him?" said the farm dog. "Naw," said the Scotty, "just show me where he hangs out." So the farm dog led him to a place in the woods and pointed out the little animal when he came along. "A clown," said the Scotty, "a pushover," and he closed in, leading with his left and exhibiting some mighty fancy footwork. In less than a second the Scotty was flat on his back, and when he woke up the farm dog was pulling quills out of him. "What happened?" said the farm dog. "He pulled a knife on me," said the Scotty, "but at least I have learned how you fight out here in the country, and now I am going to beat you up." So he closed in on the farm dog, holding his nose with one front paw to ward off the vitriol and covering his eyes with the other front paw to keep out the knives. The Scotty couldn't see his opponent and he couldn't smell his opponent and he was so badly beaten that he had to be taken back to the city and put in a nursing home.
>
> Moral: It is better to ask some of the questions than to know all of the answers.

The second parable is attributed to C. Northcote Parkinson, the exegete of Parkinson's law:

> Fifteen years ago the United Nations awarded identical contracts to two corporations: Trans-World Products, and the Sam Botts Company. Each was given $1,000,000 and told to design a writing machine that would be truly suited to African countries; the device was to be capable of writing in small letters or large, in English, French, German or Swahili. It was to withstand tropical dampness and floods.
>
> The Trans-World Products engineers went to work with a will. They used up all the money and time allowed. They produced a 200-lb. stainless steel machine, housed in a fiberglass container which included a rechargeable battery, a five-year dessicant cartridge, flotation gear, and a 100-page maintenance manual written in twelve languages. Although the first model cost over $100,000 to build, later units could be mass-produced, it was claimed, for only $1,500. The device was a marvel to behold, and the world was lavish with its praise. The president of the company was given a 15 percent salary raise, the department heads were given bigger offices. Even the stockholders in the country felt ennobled by being involved in such a successful and altruistic project. TWP's final report (in four volumes, and weighing eight pounds) is available in all major libraries.
>
> The Sam Botts Company took no visible action for many months. Old Man Botts said nothing to his department heads. He asked no one for help. He built nothing. Day after day he sat in his small office staring off into space. Finally, he mailed off a small package (a Manila envelope, which required 20¢ postage) to the sponsoring agency. The envelope contained an ordinary Faber wooden pencil, a check for $990,000 and a brief note which read: 'This machine—pencil—meets the requirements: it writes in any language, is unaffected by damp climates and, when caught in a flood, floats. Am returning the money we didn't need. Yours truly, S. Botts.'
>
> The sponsoring agency was furious with Botts. The press ridiculed him. The stockholders felt crushed; they cut his salary and eventually eased him out of the company entirely.
>
> Today, there are 320,370,000 pencils in use in Africa. No second TWP machine was ever built.

In light of the above parables, the Committee and Project Coordinator (hereafter referred to as "project leadership") began by asking the necessary questions to determine how we could best accomplish the greatest result with the most efficient utilization of the Federal and other resources at hand. Six fundamental questions were explored.

1. Who is already doing EE in Alabama? What have they developed that is of general value and use?

2. Who (individuals and agencies/organizations) in Alabama is supportive (economically and/or politically) of EE?

3. What resources already exist for EE in Alabama? To whom are they available?

4. What resources are needed? By whom?

5. Where is the demand for EE in Alabama?

6. Does Alabama have a distinctive purpose/need for EE?

Our research into the existing state of EE in Alabama brought us to the following realizations:

> Compared to most states, Alabama is in the enviable position of having much of its natural environment yet unspoiled. Whereas many states must struggle to restore environmental integrity that has been lost, Alabama for the most part has not become technologically and urbanically over-developed ("Californicated," as they say in the Northwest). On the other hand, Alabama is one of the poorest states economically. The state's enviable environmental condition may, therefore, be shortlived. Politically, both the executive and legislative branches of Alabama's government are committed to transforming Alabama into the industrial heartland of the Deep South. In political practice (as opposed to political rhetoric), economic considerations in Alabama almost always prevail over environmental considerations.
>
> Demand for EE is mostly generated either by those who are environmentally victimized and/or economically comfortable (but whose economic comfort is not directly dependent upon environmental degredation). The contrasting facts of Alabama's relatively unspoiled environment and relative economic "underdevelopment" probably account for the notable absence of public demand for EE in the state. Environmental victims seem readily persuaded that jobs are more important than a healthy environment. Alabama is deficient in population with the type of economic comfort specified above, and almost all existing visions of future economic comfort call for massive environmental degredation (or at least imply it).
>
> Since Alabama's situation is not yet bad enough environmentally nor good enough economically to provide a demand for EE, such demand has to be created by its suppliers. (There is nothing unusual about such reversals: our economy is sustained in the same manner, via advertising.)

Despite the completion in 1973 of two state plans for EE in Alabama, one for the formal sector prepared by the State Department of Education, and one for the non-formal sector prepared by the Alabama Environmental Quality Association (AEQA), there has been little EE progress within the state. The AEQA is the only organization in Alabama that professes to promote EE on a statewide basis. However, AEQA's efforts are confined mostly to the non-formal sector. Nobody--including the State Department of Education--actively promotes EE throughout Alabama's school systems. With the exception of a handful of programs at the elementary and secondary level in isolated schools and/or school districts, there is little EE taking place in Alabama's schools. And with the exception of some environmentally-oriented technical degrees or research programs at a half dozen or so of the state's 53 junior and senior colleges and universities, plus some outdoor education programs or courses at a few others, there is very little EE taking place in Alabama's institutions of higher education.

The most useful existing EE resource "native" to Alabama appears to be the K-12 curriculum developed by the Mobile County Public Schools under the direction of Dr. Michael Magnoli. This is not a separate curriculum, but one which has been thoroughly integrated into the existing curriculum at all levels. If ever a commitment to EE is made by Alabama's Department of Education, the Mobile curriculum represents a thorough and adaptable model for dissemination elsewhere in the state. Much could be accomplished in the state if the Department's specialist assigned to EE were actually allowed to promote EE.

Other existing EE resources "native" to Alabama are either too fragmentary or else too tied into a local/regional environmental base to be generally useful throughout the state. There are virtually no instructional materials dealing specifically with Alabama environments that are generally available for use in either the formal or non-formal sectors.

With the above assessment of Alabama's EE resources (i.e., the lack thereof), the Project leadership addressed the problem of defining and implementing our task to achieve maximum results via the most efficient employment of our limited resources. We maintained one overriding objective: to establish an EE effort within the Consortium that would continue not only when Federal support was terminated but also in the event that Consortium support might also be discontinued. To this end, the Project's energies were directed toward those "audiences" that were most receptive of and open to the advancement of EE:

the Project Committee itself;
the College of Education, University of Montevallo;
the community of Montevallo;
the environmentally concerned citizenry of Central Alabama;
the environmentally concerned educators and citizenry
  throughout Alabama.

Our prevailing strategy was to identify, support and amplify existing EE consciousness/efforts and to avoid dissipation of energy in direct encounter with "audiences" either hostile or indifferent to environmental concerns. This strategy was employed on the assumptions: 1) that our main objective of establishing a locally supportable EE effort must be accomplished within the only year that we could count on outside funding, and 2) that maximum longevity could best be achieved by synergizing Project efforts with complementary energies rather than by confronting indifferent or obstructive energies. In Alabama, environmentalists who don't hang together are certain to be hung separately.

Highlights

The Project's activities are best summarized with reference to the "audiences" enumerated above.

ACDHE EE Committee: The Committee's greatest interest lay in the production of EE resources. Several criteria were established by the Committee for the development of these resources, and for the selection of other resources for use by the Project:

specific pertinence to Alabama's environments;
emphasis on prevention/solution of environmental problems;
emphasis (when appropriate) on the environmental effects
  of energy production/utilization;
emphasis (when appropriate) on the environmental effects
  of resource depletion (renewable and non-renewable).

Two major efforts were undertaken directly by the Committee: the production of four slide-tape instructional units, and the editing of a bi-weekly newspaper column.

The Committee felt that slide-tape units prepared for a tenth grade audience would have the widest usability both within schools and with adult audiences. Of seven units initially proposed, four underwent actual production, addressing the following subjects:

Environmental Impact of Strip-Mining in Alabama
Solar Energy in Alabama
Alabama Forests
The Cahaba River: Natural History, Ecology and Human Impact

Each unit was developed by a specialist (three of them members of the Committee) in the subject area covered, and includes a supplemental learning activities guide with directions/suggestions for use with junior high, senior high and college/adult audiences.

Editing of a twice-monthly newspaper column entitled "Nature Scenes," for syndication throughout the state via the Alabama Press Association, was undertaken by Committee member Dr. Thomas Wilson, biology professor at Judson College. Most of the columns were written by Committee members. The columns emphasized, for the most part, current environmental problems in Alabama and potential solutions.

College of Education, University of Montevallo: Because of a recently completed addition to its physical plant, the College was able to provide the Project with excellent office facilities. This was fortunate, not only because the Project thus became involved with one of the state's major schools of teacher education, but also because, as a state institution, the University was hooked into a statewide telephone line. Few EE projects are blessed with free telephone access to their entire state.

In the interest of lending tangibility to the Project, the Project's office was designated as the Center for Environment and Energy Education. The term "center," unlike the term "project," connotes a sense of place, hence the tangibility. "Center" also enhances the sense of visibility and credibility. Finally, "center" connotes more of a sense of permanence than "project," since centers tend to be perceived as ongoing despite changes in leadership whereas projects tend to be associated with particular leadership.

The College of Education was eagerly receptive to the Project. Within one week of the Project Coordinator's request that the College add an EE course to its curriculum (to be taught by himself[2]), the course "Energy, Environment and Your Future" was approved for the second semester. The professor responsible for courses in curriculum development invited the Project Coordinator to make presentations to all of her classes, and in response has incorporated EE as a permanent component of her courses, undergraduate and graduate.

The Project Coordinator permanently donated most of the EE curriculum materials he had collected over the past ten years to the College's Curriculum Laboratory. An annotated guide to the best of these materials was prepared which, in addition to being available in the Laboratory, is also being distributed with an appropriate assignment involving the collection's use, to the students taking curriculum development.

When the Project Coordinator learned of a widely shared interest in the environmentally responsible development of several hundred acres of unused "outer campus," a lake and woods area, he convened an ongoing committee of faculty, administrators and building/grounds personnel to plan for and pursue such development. Several federal, state and county agencies, as well as corporations and local citizens, are being involved in this project, which will not only augment various programs of the University but will also extend educational and recreational opportunities to the Montevallo community.

Community of Montevallo: The Project related directly to the Montevallo citizenry by expanding an existing recycling effort and by conducting the most successful paper drive in recent Montevallo history. Attempts were also made to revive the local chapter of the Alabama Conservancy, and to bring greater environmental awareness into the thinking of the local chapters of both the Business and Professional Women and of the Montevallo Human Relations Council. (The latter organization of university, civic and religious leaders provides for socio-economic needs of the community that are not being met by existing government and private agencies.)

In all of the Project's community efforts, attention was called to the community's need to preserve the integrity of its environments in the face of rapid commercial and residential growth. Several individuals, representing all of the sectors mentioned above, were significantly affected by these efforts, but it is too soon to assess the extent of the Project's influence on the community's development other than to note that one of the Project's strongest sympathizers was recently appointed city manager.

Environmentally Concerned Citizens of Central Alabama: The Project initially came to the attention of this "audience" via the Project Coordinator's regular participation in the meetings of the Shelby County League of Women Voters, the meetings of the Birmingham chapters of the Alabama Conservancy and the Sierra Club, mailings to all members of these organizations, and newspaper coverage of the Project's activities.

The Project sponsored a one-day conference/seminar (with supplemental funding from the Alabama Committee on the Humanities and Public Policy) on the Cahaba River, Alabama's last major free-flowing river which is centrally located both geographically and demographically within the state. The conference/seminar was entitled "How Far Can We Push the River?" The Cahaba was chosen for this event because the controversies over the utilization of its waters represent the entire spectrum of environmental issues and problems: population growth, pollution, energy production, resource conservation/depletion, endangered species, wilderness preservation, urban vs. rural values systems/politics, etc. The majority of the 85 participants were (or represented) industrialists, businessmen, development interests, and federal/state/county/municipal officials.

The Project provided a boost to Birmingham's recycling program by supplying free of charge to Birmingham churches 5000 copies of a recycling flyer initially developed for Montevallo's recycling project and subsequently published for world-wide distribution by the Board of Discipleship of the United Methodist Church in Nashville. The flyer, with an insert on how to participate in Birmingham's recycling program, was offered only to those churches who agreed to call special attention to it either by incorporating it into a Sunday morning worship service or by including it in a congregation-wide mailing. All of the flyers were requested within one week, and were distributed at a time that coincided with extensive press and news media coverage of a major expansion of the city's recycling program.

Environmentally Concerned Educators and Citizens Throughout Alabama: The Project's principal state-wide communication link was the syndicated "Nature Scenes" column mentioned above. A statewide mailing to 1500 members of the Alabama Conservancy, containing reprints of the first several columns, requested that the recipients either thank their paper for including the column or else urge their paper to include the column, whichever situation prevailed. As a result of this effort, over one-half of Alabama's 112 daily and weekly newspapers had featured the column by the end of the Project year.

Approximately 5000 different persons in Alabama, including environmentalists, industrialists, businessmen, developers, government personnel of all branches, levels and appropriate agencies, and all newspaper editors and broadcast news editors, received one or more mailings from the Project at some time during the year. Each piece of mail included a form to be returned to the Center for placement on the Center's permanent mailing list. Approximately 500 persons were on this mailing list at the conclusion of the Project year, representing all of the categories listed above.

A manual entitled Teaching Environmental and Energy Education in Elementary Schools in Alabama was prepared for distribution to Alabama educators during the 1977-78 school year. The manual, designed for use by teachers who have not done EE before, features simple, basic classroom activities in seven areas (recycling, energy, pollution, food chains, endangered species, resource shortages, population), plus a guide to other EE resources (material and human) available in the state.

The Future

Predictably, the Project ceased to benefit from full-time staffing at the conclusion of the federal funding period (June, 1977). Interim direction of the Center for Environment and Energy Education was assumed by Dr. Tishler. Fortunately, the administration of the University of Montevallo was sufficiently impressed with the Project's achievements and ongoing potential that in October, 1977, the University hired a new director and assistant for the Center. Under the leadership of Ms. Jeanetta Corbett, assisted by Ms. Anne Hamilton, the Center in the coming year will:

> complete field-testing, HEW clearance and initial dissemination of the slide-tape units;
>
> expand the EE curriculum materials collection in the University's Curriculum Laboratory;
>
> promote dissemination and use of the Teacher's Manual via the Center's mailing list and via announcements in all organizational newsletters and journals that reach Alabama teachers and environmentally concerned citizens;

maintain and expand the Center's communication linkages with educational, environmental and media organizations and institutions;

provide EE consulting services to faculty and students of the University of Montevallo, of other ACDHE institutions, and of educational institutions elsewhere in the state;

establish a permanent committee of University of Montevallo faculty, administration, students and building/grounds personnel to: 1) continue development of the "outer campus" for environmental research and education, and for recreational purposes, and 2) to establish an energy conservation program for the University;

expand the Montevallo recycling program;

coordinate special programs (workshops, seminars, etc.) on critical issues of Alabama's environments;

expand the Center's financial support base, in consultation with ACDHE, industry, and government agencies.

Assessment

Like so many of the projects funded by the Office of Environmental Education, this one had all of the potentialities for being a flash-in-the-pan. The Project leadership did everything possible to prevent this from being the case. With the University of Montevallo's willingness to continue support of the Project via emergency budgeting, the Project's overriding objective was accomplished. This reflects a highly positive assessment by the University's administration of the Project's overall worth. Thus the Project's fruits are alive, well, and growing, and the Project will endeavor to increase its respect and support by the "audiences" who will benefit from the University's action.

NOTES

1. The University of Alabama (Tuscaloosa); University of Montevallo; Huntingdon College (Montgomery); Judson College (Marion); Miles College (Birmingham); Stillman College (Tuscaloosa).

2. The Project Coordinator also assisted with a wilderness survival course at the University of Alabama.

ENVIRONMENTAL HEALTH ENGINEERING AND SCIENCE: UNIVERSITY OF KANSAS

by Ross E. McKinney*

For the most part, environmental health programs are an outgrowth of sanitary engineering programs which date from 1889 at Massachusetts Institute of Technology. Today's Environmental Health programs at the University of Kansas are unique as one of the first to bring together engineering students and science students in an interdisciplinary approach to modern problems in environmental health. Increased concerns are directed toward air pollution as well as to water quality and solid wastes, and to socio-political relationships. Program research has led to three important patents on wastewater treatment devices and processes. An outreach effort features television-linked off-campus evening and weekend classes. Graduates of KU's rigorous Environmental Health programs are in wide demand.

The Environmental Health programs at the University of Kansas are unique for being one of the first programs designed to educate engineering students and science students together for a truly interdisciplinary approach to the problems of modern environmental health. The rapid developments in environmental health following World War II clearly indicated a need for both engineers and scientists if real progress was to be made in solving the problems facing the post-war generation. Most educational programs were designed for either engineering students or science students and tended to promote two separate approaches when a single approach was needed. Fortunately, the climate at the University of Kansas in 1960 presented the right environment for establishing a new approach which could accept students from widely varying backgrounds and directing them to a common goal along separate pathways. The wide acceptance of the students who have graduated from the Environmental Health program and their success in meeting the challenges to date testified to the success of this educational concept.

Origin of Sanitary Engineering

For the most part Environmental Health programs are an outgrowth of the old Sanitary Engineering programs. Sanitary Engineering was first established as a defined educational program at the Massachusetts Institute of Technology in 1889. The importance and the need for sanitary engineering education was recognized at a number of universities at about the same time. The University of Kansas established its first sanitary engineering course in 1886 and a course of study

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in Hydraulic and Sanitary Engineering in 1898. Environmental pollution problems in Kansas during the end of the 19th century and the start of the 20th century resulted in the Kansas Legislature passing its first water pollution legislation which authorized establishing the position of State Sanitary Engineer who would also be a member of the faculty of either Kansas University or Kansas State University. Because of the close relationship with the University of Kansas, the State Sanitary Engineer was appointed from the faculty of the School of Engineering. Over the years the Sanitary Engineering Division of the Kansas State Health Department grew up on the University of Kansas campus. It was only natural that Sanitary Engineering programs should be guided by the State Sanitary Engineer with most of the courses taught by members of the Kansas State Health Department. At times it was difficult to separate the two functions, with the sanitary engineering educational program being directed to meet the goals of the Sanitary Engineering Division.

Two events which changed the entire course of the Environmental Health program at the University of Kansas were the construction of a new State Office Building in Topeka and a federal grant for a new Sanitary Engineering research facility on the K.U. campus during the latter 1950s. The new State Office Building resulted in consolidation of the different Divisions of the State Health Department in Topeka and departure of the faculty responsible for teaching the Sanitary Engineering courses. The new Sanitary Engineering research facility necessitated obtaining new faculty for this area and set the stage for change.

Modern Sanitary Engineering Education

Following World War II at M.I.T. the Sanitary Engineering program started to change. There was a shift from the conventional program based on hydraulics and structures to a new type program based on chemistry and microbiology. Previously accepted design concepts for water treatment and wastewater treatment plants were challenged as a result of the engineers having a better background in the basic sciences. It became apparent that the lack of understanding of engineering concepts by the scientists working in the sanitary engineering field handicapped them in contributing significantly to the solution of the problems facing the engineers. If progress was to be made, something had to be done to bring the sanitary engineers together with the sanitary chemists and the sanitary biologists so that they could understand each other's approach to problem solving and could begin to communicate with each other in a more effective fashion. Unfortunately, most existing University programs prevented bringing engineering students together with science students without one of the two groups being penalized by having to take all of the prerequisites needed by the other group; science students could become engineering students by taking all of the prerequisites for engineering, and vice versa. The net effect of these educational requirements was to prevent the education that was needed to meet the challenges that lay just ahead.

Science and Engineering

The situation at the University of Kansas in 1960 eliminated all of the past handicaps by permitting the development of a new program which was designed to be an interdisciplinary approach between science and engineering. Theoretically, the new Environmental Health program was in the Graduate School; practically, the program was housed in the School of Engineering for budgetary purposes. The construction of the new C.L. Burt Environmental Health Research Laboratory gave the program the facilities needed to develop its own identity. In 1961 the Kansas Board of Regents authorized the M.S. programs in Environmental Health Science and Environmental Health Engineering. The new approaches that these programs brought to the University of Kansas were immediately accepted by the students and the programs flourished. In 1965 the Board of Regents authorized expansion of the programs to the Ph.D. levels.

Educational Philosophy

Over the years the Environmental Health programs have been modified and changed to meet the expanding challenges in the environmental health field, but the overall philosophy behind the programs has remained the same. It was recognized that there was a basic set of fundamental knowledge that everyone interested in environmental health should have regardless of their backgrounds and that there was a need for many different types of educational programs. From the beginning there were basic courses in Applied Water Microbiology and Sanitary Chemistry. These courses offered the opportunity to show how the basic sciences could be used to solve practical problems. Other courses examined Water Quality and the various treatment concepts employed in water treatment and wastewater treatment. Biological wastewater treatment concepts were explored from a fundamental approach to reach real solutions. The students had an opportunity to take courses in other Departments and Programs that contributed to their own programs. Each student developed his own specific program with advice and counsel from the faculty. The most important feature of the M.S. program was emphasis on thesis research. Approximately one-third of the credits for the M.S. degree were for independent research under the direction of a senior faculty member. The M.S. research resulted in a tutorial relationship being developed between the faculty member and the student much like the apprenticeships of old. Sufficient time was allotted for doing meaningful studies of interest to both the students and the faculty.

The major emphasis on M.S. thesis research was counter to the direction many Sanitary Engineering programs were taking in the early 1960s. Most programs were dropping the thesis research in favor of more course work since the thesis research required too much faculty time and lacked sufficient time for meaningful study. In many schools the M.S. programs simply became a fifth year of course work added to the four-year B.S. programs. The KU programs put the emphasis on personal involvement to show the students how to apply the information they were learning in the classrooms. Because research required a major effort on the part of the faculty, there was a real limit on the number of students that could be handled effectively. From the beginning the emphasis was on quality rather than quantity. The success of the early graduates offers testimony to the validity of this approach.

Water Quality

Initially, the Environmental Health courses were directed toward various aspects of water and water pollution since this was a major problem in Kansas and the Mid-America region. During the early 1960s the Environmental Health Programs were recognized as being a center for biological wastewater treatment. Much of the research was directed to showing how to apply fundamental concepts of microbiology and biochemistry to the design and operation of different types of wastewater treatment systems. The engineering students learned the details of process design, while the science students learned how the processes functioned. Together the students learned how to deal with each other. The science students gained an understanding of what the engineers were interested in and how they approached the solution of problems. The engineering students with their quantitative approaches gained respect for the fundamental approaches of the scientists. The mixing of these two groups of students produced varied approaches to the same problems and prevented development of stereotyped solutions that have been published in various handbooks.

Solid Wastes

In the middle 1960s there was a developing need for Environmental Health graduates with a background in solid wastes. Solid waste collection and disposal was an engineering problem that had been neglected. There was no easy place for the concepts of solid wastes to fit. Municipal governments everywhere put solid wastes at the bottom of their priorities. State Health Departments concerned with environmental pollution control ignored solid wastes except where the problems were blatantly obvious. The Federal Government was not certain it wanted to look at solid wastes but finally decided that if action was to be taken, it had to start at the federal level. Congress showed its concern for solid wastes by putting the first Federal Solid Waste Legislation through as an amendment to the Clean Air Act of 1965.

The needs in solid wastes were many. There was a need for engineers and scientists who would first examine the problem and the current methods for handling solid wastes and then develop efficient solutions. The Environmental Health program at KU shifted to put more emphasis on solid wastes. The overall objective was not to develop a new program for solid wastes but rather to demonstrate that solid wastes were just part of a single environmental pollution problem which should be approached as a unit rather than as three areas requiring three separate educational programs. The strong emphasis on special problems and research permitted the educational programs to adjust to meet this new need. The U.S. Public Health Service established traineeship programs at a number of universities around the country to attract students to this area of study. The traineeship program at KU was unique in that it was the only federally-funded program that was directed toward long-range education at the Ph.D. level. All of the other traineeship programs were for M.S.-level students to produce engineers to meet immediate needs.

The response to the development of a Ph.D. program for solid wastes produced some interesting reactions. The local newspaper had fun announcing KU had a new program at the Ph.D. level for "garbage collectors". Some of the faculty members from other departments at KU expressed concern over the fact that Ph.D. degrees might be given for such an unsophisticated subject as solid wastes. Close examination of the solid waste program showed that while the subject matter might seem rather mundane, the educational needs were far more complex than those of the more traditional areas where Ph.D. degrees were being given. The initial efforts were built on the fundamental microbiology and biochemistry which had been the basis for the initial concerns in water pollution. Emphasis was on the return of solid wastes to the environment with minimum adverse impact through better use of biological treatment concepts in land disposal.

In 1968 a request for technical assistance from the City of Lawrence set the Environmental Health program in a new direction. The need to supply answers to real problems resulted in emphasis on application of information in a politically active environment. The concurrent development of public awareness for environmental pollution and student unrest on the campuses around the country aided in the development of this approach in education. Students found themselves involved in a new situation where simple technical solutions were rejected by politically motivated groups. Research projects were no longer just technical problems to be examined in the laboratory but included problems with socio-political components. Data were collected from the real world with the educational emphasis shifting as the problems shifted.

Changing Concepts

The changes in the Environmental Health program were subtle changes within the existing framework of courses. Administrative organization of the various governmental groups affecting environmental pollution became more important, as did the meaning and significance of the various sections and subsections of the new environmental legislation. Public interest in environmental pollution decreased in the early 1970s as did student unrest, but the new directions of the Environmental Health programs continued.

Faculty involvement in research both in the laboratory and in the field together with application of their research to solving real problems has produced a faculty that is very sensitive to the education required for students to meet the challenges in environmental pollution control. There was a tendency to want to expand the various courses as more knowledge became available. The faculty had to work hard to resist this tendency toward trying to cover more and more material each new year. Periodic updating of information and occasional reorganization of the total program material met the strengths of the faculty and the educational needs of the field. The latest reorganization of the Environmental Health programs was in 1977 as a result of faculty changes. The basic philosophy of the Environmental Health programs remained the same as it was in the beginning but the breadth of the program was expanded to put more emphasis on air pollution.

Current Emphasis

Currently, the Environmental Health programs start with foundations of chemistry and biology and build through the fundamental principles of the physical, chemical and biological processes that are used to develop solutions to problems in air pollution, solid wastes, wastewater pollution and water treatment. In addition, the students are encouraged to examine the administrative relationships, the legislation affecting the different areas of environmental pollution control and systems analysis related to both large-scale and small-scale problems. Research still forms a major part of the educational experience of many of the students, but it has been recognized that some students have greater needs for additional course material and lesser needs for the research experience at the M.S. level. A non-thesis option is available for international students and for students who are working full time in the Environmental Health field and are pursuing their education on a part-time basis. Many international students come from areas of the world where the need for improved environments is urgent and the need for new solutions from research has a low priority. These international students need to maximize their technical information base by taking more courses. A Special Problem study on an important technical area of concern to their own countries replaces the thesis for international students electing the non-thesis option.

The School of Engineering has maintained an evening program for young engineers working in the Kansas City area who wish to pursue graduate education. The Environmental Health program has been a strong part of the Kansas City evening program. Many engineering firms recruit young engineering graduates by offering to pay all or part of the tuition for graduate courses. Because of the demand for courses in the Kansas City program and the inability for the faculty to meet the commitments both in Lawrence and in Kansas City, courses have been offered in Lawrence on Saturday mornings or early in the morning during the week so that part-time students and regular students can take the courses together. Evening courses have been offered by dual communication television with students both in Lawrence and in Kansas City. The television link permits communications back and forth between both locations at both the audio and visual levels. The combining of regular students with the part-time students active in practice has produced the added benefit of making the course material more relevant to real-world problems that are being faced while the course is being taught.

Research Results

During the past 16 years the Environmental Health students have been actively involved in solving real problems while learning the techniques required for solving future problems. Some of the research studies have been in the field and some started in the laboratory and moved to the field when the results proved successful. One of the first studies dealt with an evaluation of the aerated lagoon for treating domestic wastewaters. Several students had the opportunity to see how a new wastewater treatment system was tested and changed as a result of the data they generated. These studies provided the initial impetus for developing the design criteria for aerated lagoons. Four different aerated lagoons were examined and evaluated.

Research results led to other studies. One avenue which was vigorously pursued dealt with the fundamentals of complete mixing activated sludge. Laboratory studies yielded a better understanding of the activated sludge process and helped develop more accurate design constants. The research results were used to design more efficient activated sludge systems. Another avenue from the aerated lagoon studies led to a long-term study of aeration equipment, its design and testing in the field. The lack of proper aeration testing procedures led to claims by aeration equipment manufacturers that were not substantiated in the field and resulted in poor operations in many activated sludge plants. Faculty involvement with former students resulted in the development of test procedures which were evaluated with the help of students. Slowly but surely the test procedures were modified and adjusted. Over the years it is possible to see that real improvements have been made although each step seemed small when it occurred. Aeration equipment has been subjected to extensive tests with changes being made in design and manufacture. Data evaluation has become one of the strongest features of the educational program with special courses being developed for practicing engineers so that they can return to the campus and learn the latest information.

Ideas by the faculty have resulted in a continuous stream of research projects. Three patents have resulted from research on wastewater treatment processes: (1) activated algae, (2) complete mixing with pure oxygen, and (3) fixed media activated sludge. A fourth patent is pending. Since all of the patents have been the result of sponsored research from various industrial companies, the students have had the opportunity to be involved with an important segment of the field that normally has limited contact with universities on a day-to-day basis.

The positive production of new research ideas on a continuous basis has attracted attention to the students so that there has been a constant demand for graduates at both the M.S. and Ph.D. levels. By keeping the number of graduates at a reasonable level, the students have had very close contact with the faculty and have had an opportunity to learn more from that association than appears on the transcript from the listing of courses and grades. Recognition of the quality of the Environmental Health students is one of the most important parts of the program. Those students who graduated 10 to 15 years ago have become established as leaders in the firms where they have worked. They have demonstrated that the educational concepts were sound and that Environmental Health programs at the University of Kansas are meeting the objectives that they were established to meet. The Environmental Health Engineering graduates have an easier time finding employment than the Environmental Health Science graduates, but as the science graduates demonstrate their value, it is becoming easier for new graduates to find employment. Over the years engineering graduates have dominated the Environmental Health field, but there is a real need for science graduates who can help the engineers solve some of the problems which the engineers have not solved to date. The Environmental field needs lots of people with different backgrounds to work together to produce lasting solutions. Since environmental problems have been with us since the beginning of time and will be with us until the end of time, there will be more than enough room for people with different backgrounds but with a common goal.

Future Directions

The Environmental Health programs at the University of Kansas have changed over the years to meet the needs of Kansas, which have mirrored many of the needs of the nation as a whole. Increased concerns are being directed toward air pollution in addition to water quality and solid wastes. The emphasis created by greater public participation and special interest groups in the different environmental issues is producing changes in the course contents. More emphasis is being given to socio-political relationships along with the technical information needed to produce engineering solutions. With more problems developing from poor operation of engineered systems, there is no doubt that further changes will occur in the future. The Environmental Health programs will continue to change to meet the needs of the Environmental Health field. The current program is a far cry from the early programs, but it exists because it has been built on those early programs. The future programs will be built on the current program and will reflect the desires of the faculty and the needs of the people. As long as students seek out new knowledge on environmental improvement, the Environmental Health programs at the University of Kansas will be a part of their success.

HUXLEY COLLEGE OF ENVIRONMENTAL STUDIES, WESTERN WASHINGTON UNIVERSITY

by John Miles*

Huxley is a new, self-contained, upper-division college within Western Washington University at Bellingham. The faculty represent many disciplines and professions with a common competence in and commitment to multidisciplinary environmental studies. Around core courses are built three major concentrations in applied ecology and environmental science, education and human ecology, and planning and administration. Their evolution and current characteristics are described in detail by the author. He then goes on to discuss some strengths and weaknesses that have emerged in the Huxley experiment, and to speculate about its uncertain future. The bright, new world of Huxley has been followed with great interest by environmental educators around the country. They will find here a frank analysis of the hazards and happiness to be found in challenging common university norms.

Western Washington University is an institution of 9500 students located in Bellingham, a city of 42,000 in the northwest corner of Washington State near the border of Canada's province of British Columbia. Originally a normal school, Western became a degree-granting institution in 1933, a College of Education in 1937, a State College in 1961, and a University in 1977. The University is organized into a Graduate School, a School of Education, and five semi-autonomous undergraduate colleges. One of these colleges is Huxley College of Environmental Studies.

The idea for "cluster colleges" at Western emerged during the rapid growth period of the 1960's. The student population of Western grew very rapidly during this decade and members of the academic community felt that many values of smallness previously enjoyed at the institution were being lost in the growth process. The idea for small collegiate units with various academic foci was born and nurtured and several "experimental" colleges were established. The Huxley College idea officially appeared in 1966, was approved by the College Board of Trustees in 1968, and the College opened its doors to students in September of 1970. The idea for the College, originally referred to in official discussion as the "College of Environmental Sciences," appears to have emerged from the interest of influential members of the faculty who identified a need to establish a center for the study of the northwest environment. The original focus of this interest seems to have been upon the natural sciences, particularly biology and geology, but the faculty committee which produced the original plan for

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the College in 1967 recommended a college of environmental studies, giving the term "environmental studies" the widest possible definition, "recognizing that man's environment extends from his immediate surroundings to the biosphere and includes not only physical and biological entities, but also the social structure within which he functions and his cultural heritage which molds his response." Thus the broad definition of environmental studies which characterizes the College was established at the very beginning.

Huxley College was named for Thomas Henry Huxley; its philosophical cornerstone comes from the following quotation of his grandson:

> Sooner rather than later we will be forced to get away from a system based on artificially increasing the number of human wants, and set about constructing one aimed at the qualitative satisfaction of real human needs, spiritual and mental as well as material and physiological.
>
> --Sir Julian Huxley, The Humanist Frame

The major task in exploring this challenge is the discovery of new knowledge or ways of organizing existing knowledge, the dissemination of this knowledge, and its application for solution of environmental problems.

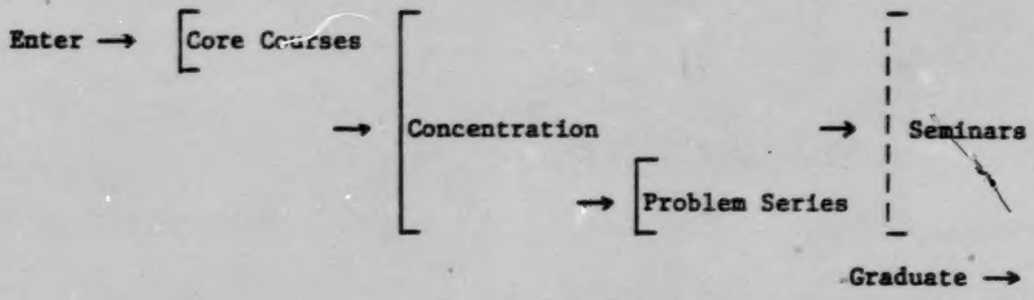
Huxley College is an upper-division program with a moderately rigorous general education requirement. Students entering the College must be firmly grounded in the natural sciences and mathematics and be well prepared in English and economics. The program assumes basic knowledge in the disciplines and moves immediately to multidisciplinary inquiry. The faculty represent many disciplines and professions. They have been appointed to the College primarily on the basis of demonstrated competence and interest in environmental studies and multidisciplinary investigation. Huxley College faculty do not, with two exceptions in 1977, hold split appointments with other departments and colleges of Western Washington University. Their work is evaluated and tenure and promotion recommended only by their colleagues in environmental studies. Engineers and ecologists, economists and chemists, planners and specialists in education are evaluated according to criteria established in the field of environmental studies rather than in the disciplines in which their degrees may have been earned. This faculty autonomy (actually semi-autonomy in practice, since discipline-oriented administrators of the University make final decisions on personnel matters) is the unique advantage that Huxley College faculty have over colleagues in many other environmental education programs in institutions of higher learning. This feature of the Huxley College evaluation may also present a unique disadvantage for the faculty member. As he or she has been evaluated by Huxley criteria, he or she has moved out of his or her discipline of training and thus risks possible difficulty in securing a faculty position in a traditional disciplinary department. A faculty member is thus committed to risk a possibly irreversible academic path when he or she steps onto the interdisciplinary turf of environmental studies.

Huxley College has enjoyed significant curricular autonomy in its seven-year history. It is a small program of fourteen faculty; its curricular decisions are made by the faculty with recommendations coming from a faculty-student curriculum committee. This two-step curricular review process has allowed constant re-evaluation and revision of the curriculum to occur. The time-consuming curricular review processes of larger academic units are absent from the Huxley College process, which has allowed significant experimentation. Students are involved in all governance and their role in the evaluation of the environmental studies curriculum has been very important. Many of the curricular changes that have occurred have come in response to student concern and initiative. There is a tendency for institutions to become inflexible and resistant to change as they grow older. Such a tendency is evident at Huxley College, and pressures to conform to structures and procedures of conventional academic programs seems to be increasing. This pressure is being resisted by the faculty and a struggle is occurring between the Huxley academic community and conservative elements of the University community at large, one which is common to environmental studies programs throughout the land. Such contention may prove to be a healthy situation, forcing environmental studies to a position of strength which it can maintain. The current position of Huxley College can be best described in terms of its curriculum.

Curriculum

The general structure of the Huxley College curriculum has not changed since it was initiated. Specific organization and presentation of knowledge within this general framework has changed constantly during the seven years of Huxley's program. The evolution of the curriculum reveals the constant effort of the faculty and students of the College to clarify educational objectives and refine the means to attain those objectives. Changes of program that have occurred over the years reveal a maturing perception of the task of environmental education and an emerging definition of it in higher education.

A student, entering at the beginning of his junior year, begins with environmental studies core courses, then selects an interdisciplinary concentration, which is analogous to a disciplinary major. Throughout his or her program a selection of seminars is required, and everyone must undertake a major independent study effort called Problem Series before graduation. This program may be illustrated as follows:



The following section of this report is a skeletal description of these basic elements.

Core: The objective of core is to give all students at the College a common background in environmental concepts essential for comprehension of man, his natural and social environment, and his reliance and influence on the environment. It seems necessary that all students of the College, regardless of their special interests and career goals, stand on a common foundation in their later studies. The core is where this foundation is laid.

Originally the core consisted of a series of five separate courses, each taught by a different member of the faculty. Students were expected to take these courses as early in their Huxley programs as possible. The courses were:

> Ecological Awareness--surveys ecological principles.
>
> Introduction to Environmental Sciences--focuses upon description of components of the ecosystem, management, analysis and measurement of the environment, and the nature of pollution and pollution control.
>
> Man, Evolution and Ecology--introduces major evolutionary mechanisms as they relate to man, ecological factors affecting man, and population problems, among other concepts and processes.
>
> Man, Social Environment and Social Values--focuses on the environment as related to behavior patterns, social structure, and economic systems with emphasis on social systems.
>
> Environmental Law and Political Action--reviews emerging body of environmental law and the various political avenues being followed toward environmental improvement.

This multiple course approach to Core was followed for three years, but it rapidly became evident through student evaluations and faculty discussion that there were problems with it. The biggest problem was duplication. Faculty often wandered in their discussion into the domain of the other courses, and students registered their dissatisfaction with such redundancy. Students and faculty alike noted that such overlap was inevitable because the parameters of discussion in interdisciplinary problem-oriented courses were neither clear nor desirable. A solution which readily suggested itself was to combine all of these four-credit courses into a pair of team-taught, heavily credited courses. All faculty teaching the course would participate all of the time, and the bridges linking the biological, chemical, social, economic, political, and legal dimensions of environmental problems could be crossed readily and with coordination.

The core was thus reorganized into two team-taught courses, originally carrying seven credits each, later reduced to five. The teaching team consisted of five faculty. The classes were very large and the format of the courses was predominantly that of lecture-examination-research paper. One discussion section per week was a feature of this approach with core faculty and senior students presiding. The content covered previously in the separate courses was integrated to provide a unified description of the present state of the environment. Problems such as human population growth, food supply, resource use and pollution were used as the vehicles of this integration. The two-course sequence concluded with examination of several case studies and a review of alternative futures.

This two-course approach is still being used, though several changes in it have occurred during its four-year history. At first, five faculty worked with the approximately 150 students enrolled in the course. As other dimensions of the Huxley curriculum expanded, this expensive approach (in terms of manpower) became unworkable. Faculty started participating only in their particular part of the core so that continuity was sacrificed. Coordination suffered and the problem of redundancy reappeared. Finally only two faculty were assigned to the core to reduce expense, one from the natural science side of environmental studies and the other from the social science side. These two faculty use problems, cases, and systems methodology to integrate the diverse subject matter.

Matters have come full circle regarding the core, for early in 1977 the faculty voted to require a set of courses of all Huxley students, in addition to the core. These required courses include Applied Ecology, Introduction to Pollution, a course from the environmental economics sequence, one from the environmental politics and administration sequence, one course dealing with values, and one from the human ecology sequence. There is current discussion as to whether it is necessary to have both a core and such a set of courses.

When the core was first taught, environmental studies was totally new in the academic world. Much material then included in the core courses is now available in newspapers, news magazines, and other publications of general circulation as well as in television documentaries. There has been a problem in keeping the core ahead of general public knowledge. Students entering Huxley College are far better informed on environmental issues than they were four or five years ago. Thus a core course may be becoming obsolete and discussion of this possibility is current with another change in the core possible soon.

Problem Series: All students pursuing the Bachelor of Science degree at Huxley College must carry out independent study. The objective of this requirement is to give the Huxley student the opportunity to focus his energy, experience and training upon a problem of the environment, primarily to learn (a) how to identify a problem; (b) what constitutes an "environmental" problem; (c) how his experience and knowledge have prepared him to perceive and analyze environmental problems; and (d) methods and strategies of problem identification, definition, analysis and solution. Each student must undertake a minimum of twelve quarter hours of such study with one or more tutors from the Huxley faculty. Problem Series may take the form of a library or laboratory study, a community study, or an internship experience. All such programs of study must be concluded with a recorded statement describing the process and the outcomes of the investigation or internship.

This requirement has remained an important part of the educational experience at Huxley College since its beginning. It is an expensive program in terms of faculty time and resources, but the support for it among faculty has not waned. There is strong belief that the application of knowledge to real problems, or experience in problem-solving organizations, is a basic dimension of the Huxley College educational experience. Problems have occurred in terms of insuring rigor and supervision in some of the studies, but these are being addressed by establishment of better procedures and uniform criteria. Graduates have testified to the value of this experiential dimension of their Huxley education.

Seminars: All Huxley students must take six quarter hours of seminars during their programs of study at the College. Seminars are taken for either one or two quarter hours of credit. They may be initiated by the students or by the faculty. A selection of seminar topics include "Foreign Chemicals and Natural Systems," "Youth Conservation Corps," "Energy and House Design," "Perspectives on Environmental Activism," "Personal Growth and the Environment," "Environmental Journalism," "Current Topics on Food and Nutrition," "Alcohol and Health," and "Fisheries Economics." Approximately thirty such seminars are offered during each academic year. The primary objective of the seminars is to allow students and faculty to explore topics of interest to them which lie beyond the normal run of course offerings. A secondary objective is to bring students and faculty from different concentrations together to share their diverse perspectives around topics of mutual interest. A large proportion of the seminars in the past several years has been taught by students, with faculty sponsorship. This is due in part to student interest in areas where faculty are not prepared to teach or are not interested in teaching seminars. It is also due in part to increasing faculty teaching loads.

Concentrations: Huxley College is an interdisciplinary program and when the College began a means was sought by which to organize the subject matter essential to the program. The device identified was called the concentration. This term was used to distinguish it from the conventional major because the latter usually refers to a specialization within the spectrum of disciplines by which knowledge is organized in the university. The concentration is not a specialization in this traditional sense, but focuses disciplinary insights upon a general set of problems. One Huxley College concentration, for instance, is Marine Resources. The ocean is an important protein source which is being inefficiently utilized and managed. Its biotic resources are being jeopardized by waste disposal and offshore oil development. This concentration assumes that to cope with such problems people must understand the ocean's physical environment, the oceanic biota and the ecological interrelations of marine organisms. The guiding theme of the concentration is that use of the biotic potential of the sea must be consistent with an understanding of the marine ecosystem. Students seeking such understanding take such Huxley courses as "Oceanography and Marine Resources," "Marine Bio-resources," "Pollution and Marine Analysis," and "Environmental Impact Statements." They take supporting courses in biology, geology and chemistry in the University's College of Arts and Sciences, and in other Huxley concentrations. The Marine Resources concentration may not initially appear much different from an undergraduate marine ecology program. The difference lies in the inclusion of economics, human ecology, planning, ethics, and considerations of pollution problems in the Huxley program. The Marine Resources program, like all concentrations at Huxley College, is thus interdisciplinary.

Originally there were six Huxley College concentrations. These were:

> Ecological Systems Analysis; Environmental Control; Environmental Planning; Hunger, Food and Malnutrition; Marine Resources; and Population Dynamics.

These original concentrations provided the organization for student programs for several years. During the seven years of the College's life, several of these concentrations have been dropped or modified and several new ones have been added. Of the original group, Environmental Control and Population Dynamics have disappeared as separate concentrations. The former has been incorporated into Environmental Health, a new concentration which emerged in 1972, and Systems and Simulations, which was first offered in 1973. Population Dynamics has been incorporated into a concentration of broader definition called Human Ecology and several additional concentrations have appeared. In 1975 the concentrations were organized in the following way:

I Applied Ecology and Environmental Science

    Ecosystems Analysis
    Environmental Health
    Systems and Simulations
    Marine Resources

II Education and Human Ecology

    Environmental Education
    Environmental Journalism
    Human Ecology

III Planning and Administration

    Environmental Planning
    Environmental Policy and Administration

The first group of concentrations, Applied Ecology and Environmental Science, focuses primarily upon the scientific and technological dimensions of environmental studies. Ecosystems Analysis, which has always been one of the most popular concentrations with students, divides its study into several parts: Applied Ecological Theory and Analysis; Causes of Ecological Disruption; and Management of Ecological Systems. The Environmental Health concentration, which incorporated the earlier-mentioned Food, Hunger and Malnutrition program, examines such problems as air and water pollution, nutrition, food contamination, overpopulation, pesticides and radiation exposure. It seeks to provide the student with tools for analyzing environmental health-related problems. Its two major options are designated General Environmental Health and Food and Nutrition. These programs are built on a foundation of common requirements such as "Applied Ecology," "Introduction to Environmental Pollution," "Nutrition," "Pollutants and Health," and "Community Environmental Health Administration."

The Systems and Simulations concentration allows students to study complex environmental problems through modeling and simulation of natural and man-made systems. Typical topics examined by students here include air and water systems, biological harvesting models, growth models, energy use and policy models, and the problem of social variables in physical models. Students in this concentration must enter with a solid background in chemistry, biology, and mathematics. They elect courses from other parts of Huxley College to give them a broad understanding of the problems to which their models and simulations are addressed. Specific courses for the concentration include "Quantitative Methods for Environmental Problems," "Systems Analysis," and "Natural Systems Simulation." These courses serve students in other concentrations as well, particularly those in Ecosystems Analysis.

Marine Resources is the fourth concentration in this group, and is one of the most highly subscribed. The College is located virtually on Puget Sound and is served by the Sundquist Marine Laboratory at nearby Anacortes, Washington. This laboratory is an important resource for this and other concentrations. These resources for study make Huxley College the ideal place to offer a marine studies program. Students take a set of common requirements which include such courses as "Marine Bioresources," "Pollution and Marine Analysis," and "Techniques of Marine Analysis." The two concentration options are Assessment and the Impact Process, and Marine Biology. The former option emphasizes human systems and their interaction with the marine environment, and the latter stresses description and analysis of the marine environment itself.

The second major category is Education and Human Ecology. The emphasis in the concentrations in this group is upon social and humanistic dimensions of environmental problems. Issues of culture and society, learning and lifestyle are examined. The Environmental Education concentration emerged in 1972. It was not one of the original emphases of the College but was developed in response to needs expressed by teachers and others working in the field of education. The goal of the program is to provide students interested in education with a basic understanding of the processes and problems of the environment and of the qualities and methodologies of the environmental education process. Education is defined very broadly and three major options are offered. The first option is teacher education, the goal of which is not to train a specialist in environmental studies but to assist in the training of teachers of one of the traditional subject areas. Thus a student pursuing this option becomes an elementary or secondary teacher, certified by the State of Washington in a recognized subject area, with a perspective on their subject derived from participation in a selection of environmental studies courses.

The second option is called Outdoor Education and Environmental Interpretation. The goal here is to prepare people to pursue environmental education in non-formal educational and recreational settings such as parks, outdoor schools, and nature centers. Students pursuing this option take a core of environmental studies courses such as "Applied Ecology," "Introduction to Pollution," "Environmental Economics," and a core of environmental education courses like "Education as an Environmental Process," "Alternative Futures," and "Environmental Interpretation." They then elect a large block of courses according to their specific interests. If, for example, they wish to become interpreters they elect courses in education, biology, geology, and anthropology. Each student's program is designed around his or her special interest within the spectrum of possibilities that exist in this broad environmental education field.

The third option is Mass Communication and Environmental Education and is offered in recognition of the significant role that mass media can and do play in environmental education. Students must take a broad core of environmental studies courses and can then elect a block of courses according to their interests. If they are interested in television production, for instance, they elect courses in the Department of Speech which offers a program of instruction in this field. They may choose to focus on development of skill in photography, radio broadcasting, or the production of educational materials.

The Environmental Education concentration is based on the idea that underlying many of the problems that other Huxley College concentrations examine is a view of the world and a lifestyle that is learned. Solutions to such problems as marine pollution and ecosystem disruption by pesticide abuse will be only partially technological. What people value and how they perceive themselves in relation to their environment will play an important part in whether or not they carry out effective technical solutions. Environmental Education asks what the problematical values and perceptions are and how they contribute to environmental problems. Further, it seeks to identify how these values are learned, what alternative problem-solving values might be, and how they can be taught. Environmental Education is thus viewed at Huxley College as a part of the broad subject of Human Ecology.

Environmental Journalism is another concentration closely akin to Environmental Education. It was originally an emphasis within the Mass Communications option previously described, but was separated out when interest grew and a cooperative arrangement was developed with the Journalism program of the University. All environmental journalism students satisfy the basic requirements of the journalism major and take a broad spectrum of coursework in environmental studies. They become generalists in the environmental studies field. All study environmental science, economics and politics, ethics and education in order to acquire the breadth in environmental studies necessary for effective environmental writing.

The third concentration in this group is Human Ecology. Students here examine cultural ecology, the dynamics of human population, environmental ethics, and environmental impacts, among other subjects. The concentration is not oriented toward a specific problem-solving role in society, as some of the others are, but seeks to give students a general grasp of the way in which human systems interact with each other and with natural systems to create problems. Students in this concentration elect courses from anthropology, sociology, geography, political science and psychology to complement their Huxley College courses. Courses offered especially for students in this concentration include "Human Ecology," "Technology, Change and Assessment," "Human Population Dynamics," and "Cultural Ecology."

The third and final major category within the curriculum is Planning and Administration. The goal of the concentrations in this group is to prepare the student to apply the social, natural and physical sciences to land-use planning and other administrative and control matters in environmental quality. The Environmental Planning concentration was one of the original programs of the College and has proven to be one of the most important. It has attracted many students, and its curriculum has been constantly changing and growing in size during its history. The concentration aims to produce an "environmentally based planner" who brings a natural scientist's understanding of environmental systems to bear on problems of human organization. Students examine processes of natural and social systems. Decision-making, data gathering and processing, and presentation of information are also emphasized.

The Planning Concentration required six quarters for completion until 1976 when it was increased to nine. The rationale behind this increase was simply that students could not acquire the knowledge and skills necessary to carry out their professional role in the rather short two-year program. The three-year curriculum allows the student to concentrate on learning about systems and about planning theory, policy and method in the first two years. The third year is devoted to studios in the three basic scales of planning—regional, urban and site. Here the student applies the knowledge gained in the preceding years in real world experiences which require field investigation, data analysis, professional report preparation and public presentation. These studios have been an exciting learning process, even during the two-year version of the program. Excellent reports on local and regional planning problems have been prepared and presented to the public and have been well received. Courses designed for this concentration include the following: "Introduction to Environmental Planning," "The Planning Process," "Graphic Analysis and Planning," "The Urban Ecosystem," "Regional Environmental Planning," "Open Space Planning," and

"Environmental Site Planning." A very important course for the College as a whole and the Planning concentration in particular is the team-taught "Environmental Impact Statements" course. This falls within the "decision process" group of electives for the concentration, as the impact assessment process is central to environmental decision-making today.

The second concentration in this group is called Environmental Policy and Administration. Here the study of environmental problems is combined with the theory and practice of policy formulation and administration. Environmental legislation and its administration is a central focus of the concentration. A core of courses is required, including "Applied Ecology," "Introduction to Pollution," "Environmental Economics," and "Environmental Impact Statements." Students then elect from two areas, the first of which is "Existing Policy" and the second is "New Trends in Policy" and includes such courses as "Energy and Energy Resources," "Alternative Futures," "Politics, Transformation and Environmental Constraint," and "Problems of Environmental Policy Formulation and Implementation." Students in this concentration are encouraged to carry minors in such fields as economics or public administration, and many of them do internships in positions in which they can study policy problems firsthand.

Several points will conclude this discussion of the concentrations. Much space has been devoted to description of them because they are the heart of the College curriculum. Discussion about the importance of concentrations and their place in the curriculum has been heated throughout the history of the program. Should the academic program be highly structured with professional training as the primary goal, or should the College provide an opportunity for students to explore the broad field of environmental studies in a relatively unstructured manner? Since the curriculum need not be such an either/or program, some concentrations, such as Environmental Planning and Environmental Journalism, provide highly structured professional preparation, while others like Human Ecology and Ecosystems Analysis allow more flexibility. Students also have the option of designing their own concentrations, but few have followed this path, especially in recent years.

Another ongoing discussion involves the organization of knowledge within environmental studies. What concentrations should the College be offering? How many concentrations should be offered? What is an optimum balance within this rather small College between the scientific side of the program and the social and humanistic side? There has been much discussion of reducing the number of concentrations. As noted earlier, some have been incorporated into others, but this has not resulted in a reduction in the number of concentrations because yet others have emerged. Undoubtedly this process of evolution will continue. The faculty regards the College of Environmental Studies as an experiment, as an exploration of new ways of studying the world and preparing for roles in the processes of modern society. As such, a constant evaluation of the program and of alternatives is necessary and the discussion of concentrations is an important part of this process.

Graduate Programs

Two proposals for master's degree programs have appeared in Huxley College's brief history. The proposed programs have not been realized because the University has not approved them. They were presented during a period of declining enrollment for the University as a whole, and early in Huxley College's history when in fact the College may not have been able to administer high quality programs at both the graduate and undergraduate levels. No graduate degree proposals have appeared for four years because undergraduate programs have grown and the College has dedicated itself to quality programs at that level. Graduate programs are currently being discussed because they can add to undergraduate education. Undoubtedly a master's degree program lies in Huxley College's future.

A Summary of the Problems and Strengths of Huxley College Problems

1. A major problem for the College since its inception has been its "image" within the larger University. It has been variously regarded as an interloper, a threat, a fad, a radical experiment and a haven for dilettantes and dabblers. Its interdisciplinary approach is suspect in disciplinary circles. Consequently much misunderstanding has occurred within the University community as to the reality of the Huxley College experiment. Criticism has at times been justified and at times not, but the history of the College has been one of difficult and unsatisfactory articulation with other academic units of the University.

2. The size of the College is a problem. Originally the projection was for a College of six to seven hundred students and forty faculty. The College was established at a moment of declining enrollment in the University, and has remained far smaller than projected. The critical factor is faculty, for while fourteen faculty can recognize the ideal goals for a College of Environmental Studies within the University, such a small group cannot achieve these goals. The scope of the curriculum, as evidenced by the concentrations, is perhaps too broad for the small faculty available, yet the best way to reduce the scope has not as yet been agreed upon. Which part of the spectrum of environmental concerns is the most important? Serious and ongoing discussion of this issue is a feature of the Huxley College community.

3. The staffing of higher education institutions in the State of Washington, as elsewhere, is based on a formula relating faculty positions to the numbers of students served. Acceptable staffing ratios have been determined for disciplines requiring various teaching methods. The problem of a proper ratio for environmental studies has been a troublesome one. Huxley College has attempted to follow an educational approach that incorporates a variety of

teaching methods, from lectures to extensive independent study, with particular emphasis on the latter. Thus it is an "expensive" program. The current era of static and declining enrollment has spawned intra-institutional competition for students, and this results in a quest for quantity of student credit hours generated, sometimes at the expense of quality. This situation presents a serious problem for a curriculum structured like that of Huxley College.

4. A problem closely related to several of the above is presented by the varied backgrounds of the students studying at the College. The mathematical sophistication of students in the "Introduction to Pollution" course, for example, varies greatly. This course is required of students in all of the College's concentrations. Students in the Environmental Health concentration bring sophisticated science and math backgrounds to the course, while people in Environmental Education who intend to be elementary school teachers are less well based in these areas. Both groups need an understanding of pollution problems, but at different levels. The smallness of the staff and breadth of curriculum make multiple sections difficult to staff. Methods of dealing with the problem are available, but the difficulty remains unresolved.

5. The general goals of the College's program have been much debated. Should the program be one of general or professional preparation? There is need for generalists with broad understanding of environmental problems in the ranks of the citizen body. There is need also for personnel with a broad background in environmental studies in several professions. What can a relatively small program like Huxley College do to meet these needs? To which need can it best respond?

   The faculty have moved in both directions, responding to students' demands for job-oriented training yet providing paths for those students who seek general knowledge without particular career aspirations. Such a small unit is limited in professional programs of quality that it can mount, as noted above. It may be that professional programs should be graduate programs where specialization can occur, with undergraduate emphasis on generalism. This discussion will go on and be resolved through exploration of graduate program possibilities and study of undergraduate job placement.

Strengths

1. General qualities of environmental education have been identified by students of the subject and can be a yardstick with which to measure the structural soundness of a program. Is it interdisciplinary? Huxley has tried to be, and has in some measure succeeded. Is it problem-solving education? A problem orientation has characterized the College. Is it process education? Varied processes

including problem solving and internship are central elements of the curriculum. Huxley College displays many of the basic qualities desirable for an environmental education program.

2. As noted earlier, the Huxley College faculty have no disciplinary affiliation with the University. This situation gives the College strength because it forces teachers and scholars with diverse backgrounds to interact and increases the chances that multidisciplinary investigation will occur. No disciplinary territoriality is present to impede exploration and definition of the new field in which people at Huxley College are working.

3. The curriculum review process of the College is responsive, allowing experimentation and constant revision. Faculty and students have worked closely together on curricular matters and the result has been a steadily improving curriculum during the College's history.

4. Huxley College is semi-autonomous within the parent institution of Western Washington University. University officials have intervened very little in the affairs of the College, and not at all in curricular matters. This organizational autonomy is a major strength of the Huxley approach to environmental studies in a public institution of higher education. This autonomy combines with the responsive curriculum process noted above to allow significant exploration of the emerging field of environmental studies.

5. Experiential learning is an important part of the Huxley educational experience. Students carry their studies to the field in a variety of ways ranging from fieldtrips and labs to six-month internships and active involvement in environmental action.

6. Huxley College is a community of environmentalists. There is diversity among the faculty and students. Some people strive to be dispassionate scholars. Others are activists, lending their knowledge to decision-making in the community beyond the College. Various lifestyles are represented and many members of the community strive for environmentally ethical lifestyles, incorporating their knowledge into an ethic and living accordingly. The College is not a "do as I say, not as I do" kind of place, but provides an example of a diverse, inquiring, and experimenting group of people united by the common concern about environmental problems.

Huxley College, in its brief history, has been primarily an undergraduate teaching institution. Research has been carried out, but so far the primary mission has been to define environmental studies and present this knowledge to the undergraduate student. The discovery of new knowledge or new ways of organizing existing knowledge is a central purpose of the College, as it must be of all institutions of higher education, but at Huxley the emphasis has so far been on the latter. The College is on a plateau in terms of size and programs. Its future is uncertain now, as it has been throughout its history. This uncertainty makes Huxley College an exciting and challenging educational experiment.

CENTER FOR GREAT LAKES STUDIES: THE UNIVERSITY OF WISCONSIN—MILWAUKEE

by C. H. Mortimer*

When you take all the feathers off, as the author suggests, the success of a university environmental studies program will be measured, "not by ephemeral events or publicity (as, supposedly, in volumes like this one), or solely by the ability to attract large extramural funds, but by substantial and original published contributions to knowledge or technology, and by the output of persons well-trained and knowledgeable in environmental matters." In this case study we find documented the findings of strategic research into limnologic and economic phenomena in the Great Lakes, the role of that research in training young environmental scientists, and the fruits of that research in husbanding the health of a great water resource, none of which would have been possible in the absence of the subject Center. Of particular interest is Dr. Mortimer's devotion to field research as the basis for conceptual modeling. As he says: "If you want to know how a lake behaves, go out in a boat and ask the right questions."

Introduction

Universities are called upon to perform a variety of functions. They serve as centers of learning and free inquiry; they provide professional training; they contribute to the advancement of knowledge; and they mobilize their resources in attempts to define and to solve problems facing society. In brief, they stand at the apex of an educational process principally concerned with the nature of man and his interactions with the environment. In North America, graduate education in the environmental field is characterized by a remarkable flexibility of choice of study themes, often transcending disciplinary boundaries and comprising both basic and applied research. Universities must continue to foster basic research, without which environmental rehabilitation and management will lack a sound foundation; but too sharp a basic/applied dichotomy can be counter-productive. There is a rewarding middle ground—strategic research—in which universities are well-equipped to operate; i.e., the pursuit of studies fundamental in nature but deliberately selected to create the knowledge or technology needed for the solution of anticipated problems and for enlightened management of resources.

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Against the background of growing controversy and adversarial procedures in environmental decision-making, universities have an increasingly important role to play as providers not only of new knowledge and skills, but also of long-term viewpoints free from political or commercial biases. And if, in its critical need for enlightened and just decisions, society is to reap the full benefit of that impartial wisdom and skill, there must also be effective channels of communication to create an informed public and an informed political process.

About one-sixth of the nation's population live and work in the Great Lakes watershed, producing one-third of the nation's manufactured output and using the Lakes in a variety of ways—as enormous water reservoirs for homes and industry, as convenient receptables for waterborne wastes, as arteries of international and internal shipping, as sustainers of commercial and sport fisheries, and as the scene of many forms of recreation. As populations and industry increase, conflicts between users (already apparent) will become more acute and will demand a degree of informed decision-making and planning far outstripping the fragmentary arrangements known today. The universities of the region will have active and decisive roles to play.

History, Objectives and Organization

The philosophy outlined in the preceding paragraphs—platitudinous perhaps, but meriting reiteration from time to time—has governed the objectives and activities of the Center for Great Lakes Studies since its establishment in present form at The University of Wisconsin-Milwaukee (UWM) in 1966. The Center (CGLS) was conceived as an interdepartmental and voluntary association of faculty and graduate students devoted to research and graduate training in various fields of aquatic science with a particular focus on the Great Lakes. The Milwaukee campus was then setting out toward a goal of "major urban university status," set by the Regents of The University of Wisconsin and later consolidated by the creation of a State-wide University System, within which UW-Milwaukee and UW-Madison were designated as doctoral campuses.

The choice of the Great Lakes and their coastal zones as the arena of university research endeavors and the choice of Milwaukee as the home of CGLS follow logically from the juxtaposition of a campus and a major port on Lake Michigan. The Lakes are objects of great scientific interest in themselves and are a rewarding and varied training ground and research field for natural and social scientists, environmental engineers, and planners. Although eight hundred miles from the ocean, CGLS functions as a marine research institute; the nature, range, and scale of activities, as they have developed over the past ten years, can best be outlined under the following sub-headings: objectives; manpower, organization and funding; facilities and services. The principal research themes and accomplishments are described in the following section.

Objectives

During the first ten years of its existence, CGLS has pursued the following objectives, although not all with equal vigor.

1. Deeper understanding of how the Great Lakes, and their drainage basins and coastal zones, function as natural and man-perturbed systems—physical, chemical, and biological;
2. Improved prediction of impacts of technological, economic, and social trends in the region;
3. Training of researchers, environmental engineers, planners, and teachers;
4. Development of engineering and institutional tools needed for enlightened planning and management;
5. Service to the University as a focus for marine-related programs, and service to the City, State, and Nation as a source of expert and impartial advice; and
6. Public education in matters related to use, rehabilitation, and conservation of the Lakes and their coastal zones.

Manpower, Organization and Funding

The organizational structure summarized in Figure 1 has evolved in pursuit of the above objectives. The Center, a unit of the Graduate School, does not offer specific Lake- or marine-related undergraduate courses; its instructional role begins at the graduate level with seminars, training cruises, and above all, education through ongoing research. Faculty members (at present 15) who work as researchers in CGLS come from a wide spectrum of departments and colleges, in which their individual teaching responsibilities reside. Support for their research and for graduate student fellowships has come from campus-funded, usually part-time appointments in CGLS and from extramural funds which CGLS has helped to generate. To this research body also belong eight full-time Civil Service employees and a fluctuating population of post-doctoral fellows, Ph.D. and M.S. students, specialists, other limited-term employees, and undergraduate student assistants. A larger affiliated body of faculty (51 at present) has a declared interest in CGLS activities and elects the Steering Committee.

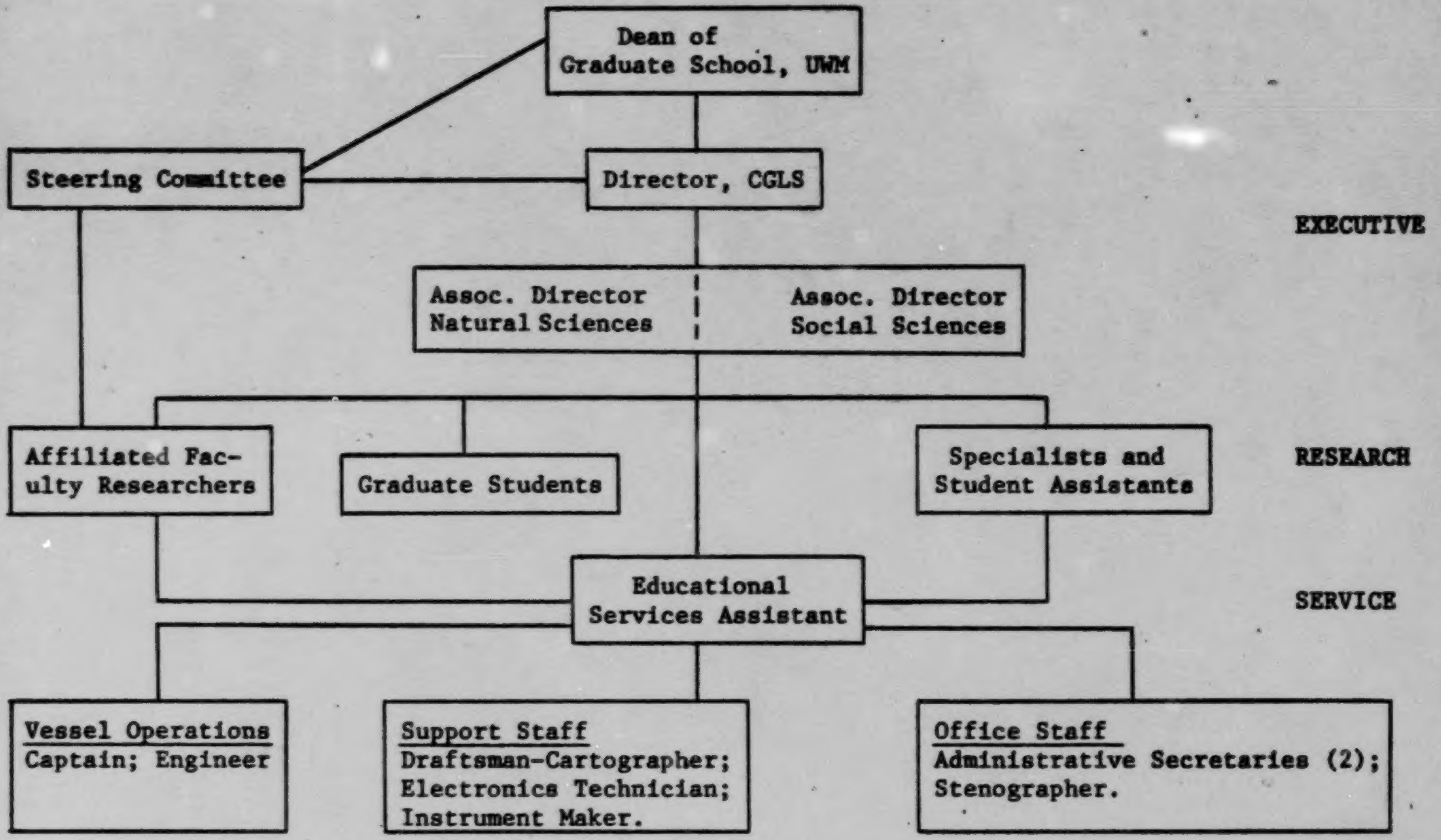
Dean of Graduate School, UWM
Steering Committee
Director, CGLS
EXECUTIVE
Assoc. Director Natural Sciences
Assoc. Director Social Sciences
Affiliated Faculty Researchers
Graduate Students
Specialists and Student Assistants
RESEARCH
Educational Services Assistant
SERVICE
Vessel Operations
Captain; Engineer
Support Staff
Draftsman-Cartographer; Electronics Technician; Instrument Maker.
Office Staff
Administrative Secretaries (2); Stenographer.

Figure 1

Note: Connecting lines represent the principal but not the only two-way channels of communication and reporting.

Over the past five years the annual campus contribution to the operating budget has ranged from $300,000 to $350,000, about half of which covers faculty salaries. Over the same period, extramural grants and contracts directly administered by CGLS have ranged from $260,000 to $300,000 per annum, not counting substantial additional funding of Great Lakes-related projects administered through other departments but using CGLS services and facilities. Judged against institutes elsewhere with comparable programs and services, this scale of support is modest, but it includes a most valuable component —continuity in the campus commitment. To this must be added the commitment to Great Lakes research by the whole University of Wisconsin System in the provision and maintenance of the Great Lakes Research Facility described below.

Extramural research funds have come from a variety of sources, from the National Science Foundation for example, but principally from federal agencies with concerns for environmental research: Environmental Protection Agency; National Oceanic and Atmospheric Administration; consortia of electric power companies with shore-based generating stations; and the (then) Atomic Energy Commission.

Facilities and Services

Emphasizing on-Lake research at the outset, CGLS assembled a "tool kit" comprising machine and instrument shops, design and drafting offices, field sampling equipment, and small vessels. To these was later added a 65-foot government surplus vessel, remodelled by CGLS for Lake-research and named R/V NEESKAY (a local Indian word for "pure clear water"). A first attempt to bring the various CGLS components under one roof failed because of a contretemps at the chosen lakeside site, but funds then approved were later applied to the purchase of a modern 125,000 sq. ft. factory with 1300 feet of dock on Milwaukee Harbor waterfront. This Facility (The University of Wisconsin System Great Lakes Research Facility) is planned to be regional in scope, to house not only CGLS but also projects and programs from other System campuses and eventually from other universities, state and federal agencies.

With the help of a grant from the National Science Foundation, in support of the regional concept, remodelling progressed in 1975 to the point where vessels could be serviced and berthed and some laboratory and office space could be brought into use. Some CGLS activities, including research vessel operations, instrument shop, and some extramurally funded projects, were then transferred to the Facility. Transfer of other units will occur in 1978 when more than half of the remaining space will have been remodelled as a suite of laboratories, shops, and services, principally with State funds. The Facility is administered by UW-Milwaukee on behalf of the whole UW System and as, for the time being, CGLS is the principal occupant, its director also serves as Facility Director with the guidance of a System-wide Advisory Council.

Accomplishments

On the assumption that the reader is interested not so much in equipment and facilities, but in what is done with them, the following paragraphs describe some examples of accomplishments and discoveries.

During the past ten years about 30 faculty members have been involved in Lake-related investigations, and 12 Ph.D. and 26 M.S. students have worked very closely with the Center, while more have used its facilities. The principal research themes—lake hydrodynamics, marine geophysics, hydrobiology, and marine transportation economics—have been determined by the talents and interests of the participants. There have been interdisciplinary collaborations, but they have been spontaneous, not contrived. Thirty-four Special Reports containing basic data and interpretations have been published and distributed to national and international libraries, and 160 research papers have been published in scientific journals.

A strong and continuing theme in lake biology has been the detection and measurement of the effects of pollution and of the nutrient enrichment (eutrophication) arising from organic wastes (treated and untreated sewage) and from agricultural sources (fertilizer applications). Surveys from research vessels and railroad ferries on Lake Michigan have confirmed persistent biological and chemical differences between coastal and offshore waters. As detectors of short-term and long-term changes in water quality, living organisms act as sensitive indicators and as early warning systems. Thus the Center's applied hydrobiological work, under contract, has provided sensitive assessment of the effects that electric power stations have on Lake Michigan through the use of lake water for cooling.

The first step in the production of living material in the lakes is taken by photosynthesizing microscopic algae (phytoplankton) which may be looked upon as the "grass" of the aquatic system. Grazing upon that grass is an array of microscopic animals (zooplankton) which in turn provide essential food for the young and some adult forms of fish. At the apex of this production pyramid stand the predator fish, which feed in their turn upon the smaller plankton-eating fish. CGLS research has illuminated some dark corners of this complex and imperfectly-understood food web.

The biological play is acted out upon a moving stage—Lake Michigan's waters. During winter those waters, except in ice-covered bays and under shore ice, are well-stirred from top to bottom by the wind; but in summer an upper warm layer some fifty feet thick is virtually separated from much colder bottom water layers by a thinner interfacial layer (the thermocline) in which temperature changes sharply with depth. Such thermal (and therefore density) stratification is characteristic of lakes in temperate regions, but the Great Lakes are peculiar in the way in which that stratification develops in spring.

It commences in shallow water nearshore in April, while the offshore water masses remain cold and well-mixed. As the season proceeds, the nearshore band of stratified water progressively expands in an offshore direction; but two months must elapse before stratification is fully established over the whole basin. The more rapid growth of phytoplankton (the primary producers) in the nearshore stratified waters at this time leads to striking inshore/offshore (i.e. horizontal) differences in biological production.

Equally striking vertical differences have also been discovered. Because almost all of the sunlight, needed for phytoplankton photosynthesis and growth, has been absorbed after penetrating through the upper fifty feet or so of water, lake researchers previously assumed that primary production (phytoplankton growth) is confined to the upper warm layer above the thermocline and that eventual depletion there of the essential plant foods (notably phosphate) brings growth to a halt. The food supplies still available in lower layers, it was thought, cannot be drawn upon because of the isolating effect of the thermocline barrier. That is the classical picture based on sampling of phytoplankton and their nutrients at discrete depths (typically every few meters) in many lakes including the Great Lakes. It is also the picture upon which environment management models have been constructed for the prediction of biological effects and costs of pollution reduction. But CGLS researchers—on regular cruises typically at two-week intervals and using pumping techniques to sample continuously through the water column—have discovered large concentrations of chlorophyll (a measure of phytoplankton crop) in narrow layers just *below* the thermocline layer during the summer months. Now confirmed over four years, this discovery means that some kinds of phytoplankton, specially adapted to photosynthesize in very low light intensities, can escape the summer starvation in the upper layer by operating below the thermocline where plant foods are not depleted, but where just enough light remains for photosynthesis. Hence this layer is only a few meters thick, being strongly light-limited as well as food-limited. This remarkably productive "deep grass" layer supports a crop of grazing animals (notably the vertically-migrating opposum shrimp *Mysis relicta*) and also fish foraging upon the grazers. Interactions within this community, now being explored and completely missed in Great Lakes ecosystem models now in vogue, play an important and hitherto unsuspected part in the biological economy of the Lake as a whole.

The above findings illustrate a principle which has guided much of the work in CGLS and which can be stated as follows. While theory, including mathematical or conceptual models, can play a valuable role in organizing thought and designing experiments, the value of such models as predictive tools will be limited until there is strong, iterative interaction between models, lake observations, and laboratory experiments. One-legged progress—models alone or monitoring surveys alone—will be much slower than two-legged progress in which modelling and verification are strongly coupled step-by-step. If you want to know how the Lake behaves or will behave, go out in a boat or deploy recording instruments and ask the right questions.

The second strong CGLS theme has been lake circulation, particularly during the season of stratification. At that time the two main water masses of the Lake, mentioned above, respond to gravitational forces associated with the stratification, to wind forces applied at the water surface, and to the earth's rotation. The combined response is such that the thermocline interface separating the two layers vibrates like a flag held horizontally in the wind. At the nearshore edges (within 10 miles of the coast) there are spectacular up and down flappings—episodes of upwelling and downwelling, which generate large waves over the whole of the "flag". These internal waves on the thermocline interface are analogous to the more familiar waves on the surface, but possess much longer periods (hours and days) and much larger amplitudes (30 feet or more). As a direct consequence of the earth's rotation, the influence of which becomes conspicuous in large lakes, one class of internal wave is trapped to within ten miles of the shore and is characterized by shore-parallel currents, while another class extends over the whole basin and is characterized by periods of 16-17 hours and currents which rotate with that periodicity.

The shifts in water masses produced in the Lake interior by the motions described above are not only of fundamental scientific interest, but also of great practical importance in controlling the transport and dispersal of wastes and nutrient materials, and setting the stage for biological production. Theoretical concepts of internal waves and numerical models have been verified through in-lake recordings of distribution of temperature and currents, paying particular attention to the dynamics of coastal currents and nearshore circulation patterns, to improve understanding of events in nearshore waters, into which waste materials and heat are discharged and initially dispersed.

A third group of projects in lake geophysics have included mathematical interpretations of the "lake breeze," often encountered as a daily phenomenon in summer, and an example of several atmosphere/lake interactions which regulate the behavior of polluted air masses over lakeside cities. Studies of lake-bed geology have been carried out on Lakes Michigan and Superior; and the magnetic properties of sediments in Lake Michigan have provided estimates of past rates of sediment deposition on the lake bottom, covering the basin's history since Ice Age glaciers retreated. Studies of beach processes and shore erosion—particularly topical in the recent epoch of high water levels—are in progress. The physical properties of lake ice-sheets have also been investigated, with support from the National Science Foundation, on the Green Bay arm of Lake Michigan and in the laboratory. Geophysical methods and sample testing have been used to determine the effect of the ice properties on shock wave propagation, deformational history, and the relationship between stress concentration and fracturing. Compared with work on sea ice, little attention has been paid to the properties of lake ice, but these are assuming practical importance in assessment of the effects of extension of the Great Lakes shipping season through the winter. Feasibility of such extension, using U.S. Coast Guard icebreakers, has been tested in recent years, and the program seems likely to continue.

This reference to navigation, one of the prime uses of the Lakes, serves as an introduction to the fourth major CGLS program concentration—Great Lakes shipping, port development with associated geographic, social, and economic interactions. This has been a substantial UWM-based component of the UW Sea Grant Program, with major reports and an international symposium as milestones generating worldwide interest. Indeed, CGLS has assembled a small but unique group of faculty members working in this field, augmented by the arrival in 1974 of an eminent urban geographer and marine transportation specialist.

Following upon the opening of the enlarged St. Lawrence Seaway in 1959, tonnages shipped to and from Great Lakes ports by ocean-going ships first rose markedly to meet optimistic predictions. But in recent years, although bulk cargoes continue to flow in substantial volume, the tonnage of mixed cargo passing through the Seaway has sadly declined. Various factors have operated to bring about this decline: the trend in world fleets toward larger vessels, many now too large to use the Seaway; the introduction of containerization and of large container ships using ocean terminals with fast turn-around time; shifts in the relative competitiveness of railroad freight rates; and the development of fast unit trains and "land bridge" trains. CGLS faculty and students are investigating and forecasting the complex effects of these trends, and of trends towards larger ships for the inter-lake trade, on the economies of the Great Lakes ports, their hinterlands, and regional transportation networks. Shifts in energy sources also present opportunities for research into regional economics and social change.

In common with other coastal regions, the Great Lakes are entering a phase in which coastal zone management strategies will be debated, designed, and tested. Because implementation will require new fiscal and institutional arrangements, the economic, jurisdictional, and political factors assume critical importance. Therefore the physical/biological (environmental engineering) models of Lake and coastal zone processes must eventually be coupled with economic/jurisdictional models, if modelling is to be useful in real life. This coupling poses a series of difficult problems, many of which will require inputs from a variety of disciplines; i.e., an interdisciplinary approach far better integrated and more spontaneous than those commonly seen to date, and an approach which universities are uniquely equipped to take.

Conclusions from the First Decade

"By their fruits ye shall know them" applies to research teams as well as to individuals. The success of CGLS will be measured not by ephemeral events or publicity, or solely by the ability to attract large extramural funds, but by substantial and original published contributions to knowledge or technology and by the output of persons well-trained and knowledgeable in environmental matters.

The test comes when university administrators and others ask whether the accomplishments noted in the previous section would have materialized if CGLS had not been created and if the funds had been applied under a piecemeal plan to stimulate and support the research of individuals through direct grants with the possibility of hiring more technicians, post-doctoral fellows, etc. While such a piecemeal plan might have produced a more efficient research team along industrial lines, university research centers should also be part of campus endeavors and aspirations. Therefore, this writer is convinced that UWM made the better bargain in creating CGLS, because of the following tangible and intangible benefits which have accrued.

First, a commitment to work in those inland seas misnamed as lakes requires equipment comparable to that of a coastal oceanographic institute; and it is unlikely that such equipment would have been assembled, or that the State and the NSF would have purchased and remodelled a Great Lakes Research Facility in Milwaukee, if CGLS had not existed. In addition the Facility, developing as a UW System-wide and regional service, is a notable experiment for which CGLS was the catalyst. At the campus level and through liaison with departments, solid CGLS support has been given in preparation of research proposals and in justifications for new graduate programs; e.g., Biological Sciences Ph.D. (approved) and Earth Sciences Ph.D. (in process). Also, gaps in teaching programs have been identified and filled with CGLS support—for example, aquatic microbiology and geophysical fluid dynamics. The presence of CGLS in Milwaukee was an important factor in the creation of a Sea Grant Program in Wisconsin and in the award of Sea Grant College status to the UW System in 1972.

Two final, critical questions should also be asked: Has CGLS attracted a flow of excellent graduate students; and has it—through national and international visibility of its research output—added a distinctive feature to the campus scene? The answers to these questions are affirmative; and they provide a good augury for the future.

NOTE

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THE INSTITUTE FOR ENVIRONMENTAL STUDIES AT THE UNIVERSITY OF WASHINGTON EXPLORES TWO MODELS OF DEVELOPMENT

by Gordon H. Orians*

Though the University of Washington has had a long and distinguished track record of concern for the conservation of natural resources, "there was a general perception that the University did not have an appropriate response capacity to environmental problems." As a result, an Institute for Environmental Studies was established. The Institute's interest in degree granting was discouraged by its governing deans because it was felt that the Institute would better serve academic needs by assuming a catalytic role to stimulate the response of the entire University to environmental concerns. Particularly noteworthy projects and programs include an Office of Environmental Mediation, an Office of Public Archaeology, an Energy Research Center, "Interns in Environmental Decision-Making," a Biogeochemical Cycles Group, and an outstanding series of public service conferences and publications focused on current environmental issues in the Pacific Northwest. Readers will find especially stimulating the author's discussion of the general philosophy underlying UW decisions about azimuths and emphasis.

An environmental studies program must establish some focus which sets boundaries to its inquiry and forms the basis upon which goals can be formulated. There is no single "right" focus because optimal structure is a function of existing programs, available talent and resources able to be channeled into program development and maintenance. The Institute for Environmental Studies (IES) at the University of Washington has been molded by these factors in a unique way, but the opportunities and constraints encountered are not without generalizable value. The Institute has passed through two major phases as two different developmental models were tried.

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Model One

In September 1972 the University of Washington Board of Regents established the Institute for Environmental Studies as a University wide educational unit for interdisciplinary program development. It replaced the Division of Environmental Affairs which was located in the Provost's Office, and was given a broad mandate to develop environmental programs at both the undergraduate and graduate levels, to encourage and sponsor interdisciplinary research, and to develop an extensive public service program. The creation of the Institute was the culmination of the work of many committees. The stimulus for these efforts was the rising public concern about the environment which resulted in the activities surrounding Earth Day in 1971. There was a general perception that the University did not have an appropriate response capacity to environmental problems and that this could be achieved only by the creation of a highly visible entity.

The Institute was located in the College of Arts and Sciences and is administered by an Environmental Studies Board of eleven deans appointed by the University of Washington president. The Dean of the College of Arts and Sciences serves as the Board Chairman. Board members represent the Colleges of Arts and Sciences, Engineering, Architecture and Urban Planning, Forest Resources, Fisheries; the Graduate School; the Schools of Law and Social Work; the School of Business Administration; the Graduate School of Public Affairs; and the School of Public Health and Community Medicine.

During its first year Institute activities were guided by a Planning and Development Committee of 15 faculty, representing diverse environmental interests and involvement. Four subcommittees initiated action on faculty selection, curriculum development, research and public service. The search for a director culminated in the appointment of Professor Robert O. Sylvester of the Department of Civil Engineering, who assumed leadership on July 1, 1973.

The Curriculum Subcommittee initially prepared a statement entitled "The Role of the Institute for Environmental Studies in Undergraduate Education," outlining directions the Institute should take to meet undergraduate needs. They recommended that the Institute:

-Develop a pool of new interdisciplinary courses.
-Develop, in conjunction with existing departments, various career preparation curricula leading to degrees offered jointly by the institute and the department.
-Develop general study programs for students principally interested in a general education rather than in specific career preparation.
-Encourage other units of the University to restructure course offerings to meet the needs of students of Environmental Studies.

The subcommittee identified four subject categories to be covered: Characteristics of the Natural Environment; Human Values and Perceptions; Interaction of Man and the Environment; and Policy Determination, Administration and Social Change.

In January 1974, the Institute, in its monthly "Environmental Outlook" newsletter, described its goals:

> "Curricularly, the Institute seeks to provide significant interdisciplinary educational opportunities. Environmental curricular contents should 1) relate life support systems to the natural and the man-made environment; 2) consider reciprocal impacts between man, the environment, and renewable and non-renewable resources; 3) involve the institutional links between people and the environment; and 4) develop strategies or alternatives for society in meeting or solving environmental problems.
>
> "On the undergraduate level, students may seek a brief overview of environmental issues or they may actually seek a strong major or minor in environmental studies. Existing degree programs provide flexibility for some undergraduates to follow either of those levels of environmental interest, and the Institute's courses and advisory service will provide programs and guidance for a wide variety of students and interests.
>
> "The needs of graduate students seeking an environmental focus are less well met. Therefore, primary attention will be given to developing a graduate degree program. Such a program would provide students with an M.A., M.S., or Ph.D. in Environmental Studies, would help to meet outside demand for trained environmental specialists, and would bolster the Institute's research efforts.
>
> "In environmental research, the first goal is to identify multidisciplinary research opportunities which match campus resources with societal and intellectual needs to better understand the environment. Hopefully, this multidisciplinary research will particularly enable IES to contribute to the resolution of environmental issues that face the State of Washington when those issues are raised either by state agencies or by citizens. A preliminary goal is to obtain funding to permit the depth and breadth of planning required to mount significant multidisciplinary research endeavors.
>
> "An important benefit of such scholarly research effort will be to stimulate the faculty understanding and skills that are necessary to ensure a high quality of teaching.
>
> "The general purpose of the public service effort is to identify and develop campus environmental resources and knowledge so that this may be brought to the general community. Hopefully, the University's scientific knowledge can bring objective and expert viewpoints to difficult and often controversial environmental issues.

> "This public service is provided, in part, through continuing education courses on current environmental topics. In addition, the public service office provides sponsorship of seminars, workshops and conferences; issues a quarterly newsletter, "Environmental Outlook"; and publishes papers and booklets on basic environmental resources and issues.
>
> "In the future the public service office will expand its ability to respond to specific environmental inquiries from government, industry or the public. Further, it plans to add to its ability to initiate and conduct study on short-term environmental issues of regional concern."

During the three years Professor Sylvester served as director, the Institute made substantial progress toward these goals. Courses were initiated in those subject areas. Three faculty members joined the Institute, two full-time and one jointly with the Department of Geography. Many adjunct faculty members from diverse departments and professional schools at the University contributed their talents to curricular development, public service and faculty research. The public service program grew rapidly and, through many conferences, public forums and short courses, became widely known throughout the Pacific Northwest. During this period the externally funded Office of Environmental Mediation, the Office of Public Archaeology and the Washington Energy Research Center were added to the Institute.

Interdisciplinary research activities proved more difficult to catalyze and, despite the work of a number of committees in such areas as Chemicals in the Aquatic Ecosystem, Chemicals in the Atmospheric Environment, the Built Environment and Lake Management, faculty research programs changed little from what they were prior to the establishment of the Institute. The Built Environment Group did receive funding for its studies of energy conservation and the design of state buildings and a few short-term projects were completed, but permanent research activities failed to develop even though some seed money was available.

In its curricular developments, the Institute moved to gain authority to offer both undergraduate and graduate degree programs in Environmental Studies. These efforts culminated in a proposal to the Environmental Studies Board in May 1976 outlining the planned curricular structure, but the proposal was not viewed favorably by the Board. Most of the deans were unsympathetic toward the idea of converting the Institute into a department offering the full range of degree programs. Instead, they envisioned the Institute catalyzing the response of the entire University to environmental problems by fostering better exchange between departments and schools. Accordingly, the Board rejected the request.

This decision coincided with the end of Professor Sylvester's three-year term as director. The task of redefining the efforts of the Institute fell to its second director appointed on September 1, 1976, Gordon H. Orians, a professor of Zoology at the University of Washington.

Under Professor Orians the Institute has attempted to develop an effective program based on the prerequisite that its students receive their undergraduate and graduate degrees in other academic units of the University or through a general studies program in The College of Arts and Sciences.

Model Two

The advantages experienced by a department offering undergraduate and graduate degrees are well known. An undergraduate curriculum generates the student credit hours so important at most universities for access to funds to support faculty and associated educational services. In addition, students find an institutional identity, in their majors, and receive direction. Faculty members more readily develop feelings of common purpose and are usually housed near each other to facilitate regular close contact with students and other faculty.

The disadvantages of a departmental model for an Institute for Environmental Studies are less obvious. Unless an environmental studies program embraces a rather narrow focus, it is likely to consist of one or at most two specialists in each of a large number of disciplines. While this provides some interchange of ideas between individual faculty members, it seldom provides meaningful, intellectual intercourse among disciplines. To avoid stagnation in their areas of expertise faculty must keep in contact with other academic units; but the departmental model makes this contact more difficult, and the demands and excitement of building an institute may compete successfully with intentions to seek it. The result is likely to be a decline in the quality and vigor of the scientific underpinnings of educational and research programs.

This is a very serious problem because the complexity of current environmental problems demands science of the highest quality. Related to this basic intellectual problem is the tendency for degree programs within institutes to be characterized by cursory exposure to many subjects but little depth of analysis of any individual topic, a preparation less than optimal for advanced education and for creative involvement in complex environmental problems.

The disadvantages of a nondepartmental or catalytic model are obvious. Funding, cohesion of students and faculty, and focus are more difficult to develop, and the lack of structural social supports leads to a greater dependence on dynamic social supports and, accordingly, places a heavier burden on intellectual leadership. Nonetheless, the fiscal and academic situations at the University of Washington have forced the Institute to explore fully the advantages of this more difficult model in ways that probably would not have occurred had the traditional departmental model been viable.

The potential advantages of a catalytic model, though difficult to conceive and execute, are nonetheless substantial. If the goal of stimulating the response of an entire university to environmental concerns is established, one's attention is focused on its total intellectual resources and the ways in which they can be more effectively focused on key environmental issues. Much progress has been made in this direction during the year the Institute has been exploring a non-degree-granting model.

The present undergraduate educational program of the Institute seeks to introduce the scope of environmental problems, and to define the contributions of various disciplines toward their resolution. The Institute's main introductory offering is a series of three courses, primarily for sophomores, the first two covering the contributions of the natural and social sciences to the understanding of environmental issues and the third a laboratory and field course. Many students take these courses to obtain a general picture and do not formally pursue environmental studies further. For those motivated to continue, the Institute is preparing a set of brochures of the form "So you are an economist (geologist, atmospheric scientist, zoologist, botanist, chemist, etc.) and you wish to enhance your understanding of environmental problems. Here is how to use your distribution requirements and electives to accomplish this end." It is intended to have brochures for every appropriate major at the university and to have copies available in all departmental and college advising offices. If successful, this program should help broaden the horizons of students majoring in disciplines that make basic contributions in resolving environmental problems. Such finely focused advising materials are more useful to students than long lists of environmentally-related courses, because the brochures represent the considered opinions of many faculty members knowledgeable about environmental issues. However, they are only suggestions and are not codified into sets of requirements, and students can accept, reject or modify the advice.

At the senior level the Institute is developing a small number of courses oriented around complex but important environmental problems which have humanistic, social and scientific components. Most major environmental problems have these characteristics and are generally suitable topics around which students can integrate their store of knowledge. The first course of this nature to be developed is in the area of "The Ecology of Food and Population," and others are planned.

At the graduate level, the Institute is attempting to play a role in broadening the preparation of scientists for professional careers. During recent decades, graduate programs at major American universities successfully responded to the need for large numbers of faculty members to staff departments of newly-created colleges and universities and the expanding departments of existing ones. This important task is essentially over and the academic marketplace will, in the foreseeable future, absorb a much smaller number of Ph.D.s than in the recent past. Responses can fall into two broad categories. First, we could elect to reduce greatly the size of graduate programs, concentrating instead on the production of a small number of highly skilled persons, each receiving a high level of faculty investment. Second, the current number of graduates could be maintained but with an expanded range of employment opportunities for which these graduates are prepared. The extent to which expansion is desirable varies with the discipline. Academic science departments range from those which traditionally expect nearly all of their students to assume teaching positions (most Zoology and Botany departments), to those expecting many of their students to be employed by private industry and governmental laboratories (many Chemistry and Geology departments). In all cases, however, the fraction of students accepting non-academic positions is increasing, regardless of whether efforts have been expended to help prepare them for these forms of employment.

The Institute's graduate program, entitled "Interns in Environmental-Decision-making," is designed as one response to this need. Its goal is to prepare science graduate students to perform policy analysis in governmental agencies, private industry, consulting firms and citizens groups. These students begin with a depth of scientific expertise typical of top quality doctoral students in the respective disciplines, but in addition they receive experience in policy aspects of their science. The program includes theory and case history courses in science and environmental policy; an internship during which they are involved with the use of scientific information in environmental policy decisions; and a post-internship seminar in which they exchange information on their internship experiences and write a detailed analytical paper on the role of science in shaping policies in the agency or firm in which they serve.

To work, this program must be of value both to students and employers. Science and technology should provide means of surmounting technical, economic, or institutional barriers. But, too often, the inherent promise of scientific expertise yields only disappointment and unrealistic expectations. Interns should be a source of new information and ideas to their employers. In particular, they should be able to contribute to discussions of technical issues bearing on decisions within the agency or firm. In turn, the interns should become more fully aware of the conflicts and constraints within agencies or firms that limit the responses available. They should also learn how scientific information must be organized and "packaged" to be of maximal use. Interns should, finally, be able to explore their own talents and interests in this type of employment and assess the added career options and job skills that the internships have provided them.

These advantages can only be realized, however, if great care is taken in the selection and preparation of students prior to their service as interns; and if efforts are made to match their talents with the needs of their employers. The quality of students is maintained at a high level by selecting only top graduate students from science departments and science-related professional schools at the University of Washington.

These departments have national and international reputations and attract excellent students from all over the United States. The quality of preparation is guaranteed by the Institute staff involved in teaching the pre- and post-internship courses. Matching of students to internships is enhanced by the efforts of the Assistant Director of IES, who has prime responsibility for developing contacts with potential employers, determining the needs of those agencies for interns, and seeking from among the pool of qualified students those best suited for each internship. The Institute's first group of students is now enrolled in this program.

The problems associated with successful development of this type of program are formidable. The easiest course of action is to give students exposure to concepts of administration and public policy formulation. Though there are a number of successful programs of this sort we have elected a different approach because of our perception that this tactic tends to weaken the quality of scientific input to private and public decision-making. It is all too easy to have the scientific knowledge necessary to solve some environmental problem or at least to make a creative input to its resolution, but to fail to apply that knowledge when it is needed. Skill in recognizing the utility of basic knowledge must be developed like any other skill, through practice. Teaching such skills requires scientists experienced in policy applications, rather than conventional political, administrative or economic analysts. Also, the complexity of current environmental issues requires the best scientific talent available. It is no secret that the quality of science is generally poorer in governmental agencies, industry, and consulting firms than in universities. Some of the disparity is doubtless due to the routine nature of much of the science needed for establishing regulations or meeting the requirements of the National Environmental Policy Act. Nonetheless, some of the disparity is due to problems these employers have in attracting and holding top quality scientists and to the recency of environmental concerns and their legal and institutional formalization. The task of changing attitudes within universities towards employment in these segments of society and bringing about the changes needed within those segments to foster better quality science will not be accomplished easily or quickly, but the Institute hopes to make a modest contribution to it.

Interdisciplinary research is as difficult to catalyze as it is important. There are several reasons for this. First, and most important, good scientists normally are deeply involved with interesting research and have built the intellectual contacts they feel they need within the university community. Calls for team research are perceived as unwanted invasions of their precious time, a substitution of unproductive committee meetings for productive research. This perception is often, though not always, correct, and the frequency of its correctness is such as to make good scientists highly skeptical of so-called interdisciplinary research. Second, overcoming the adverse effects of the physical separation of researchers with common or overlapping interests requires extra efforts that are all too easily submerged in the busy pace of university life. Finally, the system does not reward these efforts at a level commensurate with the price paid for them.

Therefore, it is necessary for an Institute for Environmental Studies to raise benefits and lower costs sufficiently to alter the behavior patterns of individual faculty members. Areas of overlapping research interests where facilitation of contacts can make a substantial contribution to the quantity and quality of output must be identified. Existing problems perceived by faculty members provide the initial motivation for the time investments necessary to launch these efforts. Appeals to social conscience and the responsibility of scientists are normally ineffective continuing motivators.

During the winter of 1977 the Institute's Chemicals in the Aquatic Ecosystem and Chemicals in the Atmospheric Environment groups were incorporated into a more comprehensive group on Biogeochemical Cycles composed of faculty members from the departments of Atmospheric Science, Chemistry, Zoology, Forest Resources, Oceanography, Civil Engineering, College of Fisheries, and Environmental Health. A weekend meeting at the University of Washington's Lake Wilderness Conference Center resulted in a consensus that an integrated course and text on biogeochemical cycles would be a valuable contribution. Subsequently, a steering committee prepared an application to the Rockefeller Foundation for support for a seminar series and a manuscript editor. This project is expected to begin during the spring of 1978.

Communication between the university and the local community requires sensitivity to the needs of potential users of information and knowledge of the nature of research being carried out in laboratories throughout the campus. It also requires a capacity to respond to requests for information, and to organize workshops, conferences and debates on current local environmental problems. The Institute for Environmental Studies responds to both of these needs. A Public Service Coordinator is experienced in the design, preparation and execution of public meetings, with approximately 50 percent originating within the Institute and 50 percent originating at the request of outside agencies, groups, and other University of Washington departments. An Information Specialist is building the required internal information system and adding to the contacts with legislators, other public officials journalists, citizens groups and trade groups already established by the Public Service Coordinator.

Institutes are ideal places in which universities can experiment with new and unusual programs whose long-term suitability within the academic framework is uncertain and which, therefore, are difficult to initiate within standard departments. The IES at the University of Washington currently houses several such programs. The Office of Public Archaeology engages in reconnaissance, salvage, interpretation and publication of data on prehistoric sites threatened by projects involving movement of significant amounts of soil, raising of water levels, or construction. The salary of the director is paid in part by funds from the Washington State Department of Highways, the remainder coming from grants and contracts for the performance of specific archaeological work.

The Office of Environmental Mediation, funded by grants from the Ford and Rockefeller Foundations, was created to explore the potential role of mediation in the resolution of environmental disputes. Drawing upon experiences with mediation of labor disputes, its leaders have sought to discern the ingredients which foster successful mediation and have successfully mediated disputes involving dams, highways and dredge spoils in western Washington. Efforts are underway to explore the role of mediation as a means of guiding discussions and directing research in areas destined to become major environmental issues before positions become polarized.

The Washington Energy Research Center carries out research on regional energy policy, including such topics as oil transport on Puget Sound, solar energy possibilities for the Pacific Northwest, and planning for future electric power developments. In cooperation with the Institute it has participated in a grant from the Department of Health, Education and Welfare to prepare a series of short papers describing various aspects of the history and prospects of electric power planning in the Pacific Northwest, centering around the critical regional role of the Bonneville Power Administration.

Given the diverse nature of programs within the Institute and the small number (five) of faculty members paid wholly or in part by Institute funds, the Institute depends heavily upon the voluntary contributions of adjunct faculty members in many different departments. In addition, the role played by non-academic staff in the general functioning of the Institute, innovative approaches to Institute programs, and interfacing with the public are much greater than in a typical university department. To be effective contributors to policy formulation, scientists must interact with persons of diverse skills and experiences. Development of these communicative skills in the context of top quality science, is the challenge of environmental studies programs everywhere.

ENVIRONMENTAL PROGRAMS, SCHOOL OF PUBLIC AND ENVIRONMENTAL AFFAIRS, INDIANA UNIVERSITY

by J. C. Randolph*

Many environmental studies programs grew out of the "hard" environmental sciences and only later added a social science dimension. Not so at Indiana University. IU's Environmental Programs, School of Public and Environmental Affairs, have their roots in part in the pioneering environmental-policy concerns of a distinguished political scientist, Keith Caldwell, and retain today a strong emphasis on the application of environmental science to the policy-making process. Student options now range from a two-year certificate program and a bachelor's concentration to several master's programs and a Ph.D. minor. IU's approach features internship experiences in environmental agencies, a sophisticated career counseling and placement service, and student involvement in School research projects on environmental systems. While drawing on the strengths of the conventional disciplines at IU, the Environmental Programs have an in-house faculty reward system and budget, all of which the author implies are essential for the level of success achieved in filling public places with able young professionals and in mounting a research program attuned to national needs.

Introduction

A description was prepared in June 1973 by Craig E. Nelson, then Director of the Environmental Studies Program, at the request of the National Association for Environmental Education for submission to the Center for Development, as a case study for possible use at the International Workshop on Environmental Education at the Post-Secondary Level. This revised and updated version was prepared on request for inclusion in the present collection.

Historical Resume

The need for an interdisciplinary program at Indiana University dealing with the influences of science and technology on society with special emphasis on the environment was suggested by individual faculty members as early as 1963. A proposal for an interdisciplinary environmental studies program was initiated in 1965 by professors from three departments (Microbiology, Political Science, and Physics). However, it was not until the summer of 1970 that support for such a

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program reached a "point of critical mass." The factors that changed university receptivity between 1965 and 1970 included the discovery of environment by large numbers of students (especially in 1969) and an attitudinal change in natural sciences from skepticism of the need and feasibility of an interdisciplinary approach to concern that scientific knowledge be applied to the emerging environmental issues. This intervening period also saw the development of some courses in environmental aspects of traditional departments (e.g., Environmental Policy, Environmental Biology) and of an experimental interdisciplinary course (Environment and Man).

At an ad hoc meeting of the natural sciences faculty in July 1970 there was unanimous agreement on the desirability of such a program, but questions of program status and curriculum remained unanswered. Specific proposals were invited for the next meeting that was held in September. Programs at other universities and existing courses at Indiana University were discussed and a curriculum subcommittee was appointed. A program submitted by the subcommittee was approved with some modifications by the ad hoc committee in November 1970, and was subsequently presented to and approved by the University administration. An Environmental Studies Program was established in May 1971. An undergraduate major in Environmental Studies was first offered by the College of Arts and Sciences in the Fall of 1971.

The University concurrently decided to seek state approval for the establishment of a School of Public and Environmental Affairs (SPEA). The School was given final approval early in 1972. A number of existing programs were transferred to the new school. These included the Environmental Studies Program, the Urban Affairs Program, the Aerospace Applications Research Center, and the Program on Science, Technology, and Public Policy. An undergraduate concentration in Environmental Policy for students pursuing a Bachelor of Public Affairs in SPEA was initiated in the Fall of 1972. A graduate concentration in Environmental Policy for students seeking a Master of Public Affairs degree (SPEA), a graduate minor in Environmental Studies (for students seeking the Ph.D. in other areas), and a Certificate in Environmental Studies (available to undergraduate students in any division of IU) were offered in the Fall of 1973. The Master of Science in Environmental Science (SPEA) degree was approved in the Fall of 1974.

Present Programs

Most of the environmental programs at Indiana University emphasize the application of environmental science to the policy-making process. The approach is solution-oriented. Most programs provide a basic background, with varying emphasis, on technical skills, applied science, and knowledge of the political process. Students become specialists in particular aspects of environmental issues, yet have broad perspective in terms of technical abilities and socioeconomic concerns. For those who would like to increase their awareness of environmental affairs, but who do not want a specialized career-oriented program, there are additional courses of study available.

Certificate in Environmental Studies. The Certificate in Environmental Studies is available to undergraduate students in all schools of the University, and is the equivalent of a minor. The program for the Certificate is designed to introduce students to selected aspects of current thinking and research on the nature, causes, and solutions of environmental problems. The program involves cooperation and contributions of faculty from a variety of disciplines and schools.

Associate of Science in Public Affairs, Environmental Concentration (SPEA). The Associate of Science degree is a 60-credit, two-year program. The program is designed to augment the skills of individuals now employed in various public service occupations. It is also appropriate for high school graduates who desire only a two-year degree. The degree also allows a student to make normal progress toward the Bachelor of Public Affairs, thus leaving open that option should the student decide not to terminate study after two years. The Environmental Concentration provides an introduction to environmental problems and the options for their resolution. At the same time, electives may be selected that are particularly suited to the student's goals.

Bachelor of Arts, Environmental Studies Double Major Program (College of Arts and Sciences). As part of the liberal arts curriculum, the purpose of this program is to increase the student's awareness of environmental affairs and stimulate critical thinking about current issues. The program consists of a multidisciplinary study of the effects on the environment of population growth, resource utilization, energy generation, and agricultural systems. Environmental issues will also be examined with regard to their impact on public policy. The double major program allows the student to acquire a wider range of specialized tools and perspectives in dealing with environmental concerns.

Bachelor of Science in Public Affairs, Environmental Policy Concentration (SPEA). The BSPA with an Environmental Policy Concentration focuses on public administration and environmental affairs. The program provides specific skills to prepare students for work on environmentally related issues, primarily at the state and local government levels. This concentration includes training in organization theory and group behavior, general public administration, and quantitative skills, combined with a concentration in environmental policy.

Bachelor of Science in Public Affairs, Environmental Health Management Concentration (SPEA). There is a growing need for environmental health specialists in local and regional communities who combine expertise in environmental management and program administration. The Environmental Health Management Concentration examines the technical aspects of environmental health and its relationship with socioeconomic problems. Students are provided with a strong public policy background as well as exposure to relevant areas of the natural sciences and applied technology. Graduates integrate proficiency in budgeting, management, environmental health planning, and the analysis of the socioeconomic impact of various program proposals, with knowledge about hazard abatement technology.

Accelerated Masters: A Five-Year BA/BS-MSES Combined Program. This program allows a student to establish a five-year course of study through which s/he can complete the requirements of both a Bachelor's degree in science or mathematics and a Master of Science in Environmental Science (MSES) degree. Students must specify in their applications the courses they propose to take in order to complete both the Bachelor's and MSES degree.

Master of Public Affairs, Environmental Policy Concentration (SPEA). The MPA program is a 48-credit hour, interdisciplinary course of study. Its purpose is to equip the student with the necessary skills and knowledge for professional positions in local, state, federal government or quasi-governmental service. The Environmental Policy Concentration is designed to appeal to students outside of the natural sciences, but who have an interest in environmental affairs. This concentration will enhance employment opportunities by increasing the student's ability to perform specific analytical or technical skills relevant to environmental policy. It is also appropriate for students already in a profession who are either seeking specific skills or desiring to modify a strong technical base in order to embrace wider environmental and administrative perspectives.

Master of Science in Environmental Science (SPEA). The increasingly technological nature of our society and the consensus that environmental affairs must routinely be considered in formulating both public and private policy have created an unprecedented need for individuals whose expertise spans both administrative and technical fields. The goal of the Master of Science in Environmental Science program (MSES) is to produce a new kind of professional who combines specialization in a particular environmental science area with the basic social science and administrative skills necessary for integrating this knowledge into a broader conceptual and operational framework. The degree allows specialization in either disciplinary or interdisciplinary applied environmental science areas. The MSES degree is offered by the School of Public and Environmental Affairs with the cooperation of several departments in the Graduate School.

Dissertation Minor in Environmental Studies (Graduate School). Students in Ph.D. programs at Indiana University may, with the consent of their committees, choose Environmental Studies as an outside minor. This allows students to take Environmental Studies courses that provide them with relevant additional information. The minor is flexible, and is usually designed by the student in accordance with his/her needs.

Institutional Organization

These environmental programs are administered by the Director of Environmental Programs under the general guidance of the Dean of the School of Public and Environmental Affairs in accord with policies established by the Environmental Studies Committee. The Director and Committee are appointed by mutual agreement between the Dean of the School of Public and Environmental Affairs (SPEA) and the Dean of the College of Arts and Sciences (COAS). The Committee is intentionally interdisciplinary and presently consists of the SPEA Environmental Science and Policy Faculty and members from each of the following COAS departments: Biology, Chemistry, Geography, Geology, Economics, Physics, and Political Science. All members are involved in environmental teaching and research.

The questions of the most desirable organizational base for managing an environmental studies program is difficult to answer in the abstract. Presumably, if funds are readily available, the ideal is a new organization large enough to offer the entire academic program for all of the various kinds of training contemplated and large enough to support the other services necessary. Because this requires not only numerous faculty and massive amounts of space but also libraries, major computer facilities, provision for student services, etc., it is only relevant when a commitment to establish the equivalent of a new university is at hand. When an environmental program is to be established within an existing university, the question becomes less what the abstract ideal is and more a setting of priorities in terms of the functions that must be funded to make the new program effective. In this regard an interdisciplinary program with the power to offer courses and degrees and to recruit faculty to fill critical gaps has some distinct advantages. As an interdisciplinary effort, good communication is maintained with existing programs, petty jealousies are largely minimized, and maximum use is made of existing resources. This is especially advantageous in the case of prominent environmental specialists who are already associated with existing programs. This of course assumes reasonable cooperation between existing programs. In our case this has certainly been true. The program has developed at a satisfactory rate in circumstances where resources for a large independent program were clearly not forthcoming.

Our strategy of an interdisciplinary program was predicated on the maximal use of the teaching facilities of existing departments. Our initial research strategy was based on the stimulation and coordination of cooperative projects between faculty in other departments. As faculty specific to the program have increased, projects based largely on our own resources have been initiated. The main institutional constraints on the development of the program have been in the requirements for course and program approval (to which all academic programs are subject) and requirements for classroom and laboratory facilities. Like all other budgets, ours is determined by proposals by the program staff, which are then balanced by the Dean of the

School of Public and Environmental Affairs against the needs of other programs. The criteria utilized include demonstrated student demand and plans for University development.

Educational Processes

Our programs consist of two types of courses—interdisciplinary courses taught by program faculty and courses in standard academic departments taught by the regular faculty of those departments. Nearly all of the departmental courses have been developed within the last few years in response to student demand and to the needs of this program. The disciplines involved include ecology, physics, geology, geography, economics, political science, and sociology. These courses were largely developed as a result of the desires of particular faculty members to offer courses with an environmental focus. The selection has thus been largely self-selection, and has invariably reflected high levels of motivation and commitment and either long-standing expertise in environmentally related areas or a desire to begin specialization in such areas. The only selection with respect to attitudes toward subject and toward students has been the necessary desire to develop voluntarily a new course at the appropriate level. The diversity of attitudes regarding the seriousness and optimal solutions to various environmental problems has effectively introduced the students to the complexity of environmental issues and the constraints of disciplinary viewpoints.

A main criterion in recruiting faculty for the SPEA Environmental Programs has been the acquisition of professional perspectives not otherwise available, especially of those kinds that cut directly across standard academic disciplines: regional planning, environmental engineering, environmental impact analysis, water resources, and the impact of science and technology on government and society. In our recruiting of program faculty, specialization in particular areas has been primary, as has been evidence of general ability. Motivation and level of commitment have been inferred from achievements. Teaching ability is very difficult to evaluate prior to observing classroom performance, except that individuals who cannot give a clear and interesting seminar are not normally considered further. A balancing between knowledge and teaching ability occurs over the long term in that teachers who are ineffective at lower level teaching but good with advanced courses and seminars are encouraged to devote more of their effort to advanced courses and vice versa.

Non-University based professionals are routinely brought in for seminars and class sessions. Particular emphasis has been on local, state, and national officials and nonacademic research institutions. Their presentations are commonly invited on topics of current general interest that have been considered in class (e.g., effluent charges) or on topics that compliment academic subjects (e.g., environmental control at the state level). Visitors are routinely asked for their perceptions of training needs and their evaluation of current and proposed courses and programs.

Teaching Methods

Our interdisciplinary introductory course has evolved from one where approximately 25 faculty or guests each presented one or two lectures to a present program of a single faculty member who gives most of the course but with several outstanding faculty invited to give guest lectures. The problem with too many faculty is that students are continually presented with new idiosyncracies that inhibit learning and that too much time is spent at very general levels and too little in integration. We attempted a somewhat similar approach in our graduate curriculum: the courses "Environmental Systems Dynamics" and "Political, Economic, and Regulatory Aspects of Environmental Management" were taught as one combined course by three faculty with divergent backgrounds. Some innovation involving the assignment of more than one faculty member to a course may be desirable for the synthetic aspects of graduate environmental programs; however, the logistics of such arrangements prove very unwieldy and thus we have largely discontinued this practice. At the present time, our teaching methods are rather conventional, with a single professor having responsibility for each course. As suggested earlier, we have found occasional guest lecturers to be most helpful in certain of our courses.

Research

Research is a rubric that encompasses a large number of different processes. Undergraduate student research serves mainly to increase the depth and realism of the student's education. However, a number of important secondary functions have been served by undergraduate research; both field studies and literature surveys have been done on questions relevant to the activities of the City of Bloomington Environmental Commission, to planning agencies, to University operations, and to faculty research projects. Graduate student research fulfills the same functions as undergraduate research and in addition generally includes significant applied research.

In 1977 the Environmental Systems Application Center was created to expand the academic program in the School of Public and Environmental Affairs through the addition of interdisciplinary environmental research and community education projects. The Center conducts environmental research in applied ecology and natural resources, as well as analysis of the impact of human activity on the natural environment. In addition, the Center is concerned with the socioeconomic, legal, and institutional aspects of environmental regulation and planning.

The Director of the Center is also the Director of SPEA Environmental Programs. The core research staff is composed of SPEA faculty and graduate students, whose backgrounds span several disciplines. Faculty of the SPEA Environmental Programs also regularly interact with faculty from the other departments at Indiana University. Inter-institutional efforts are supported and encouraged by the Center when the solutions to research problems require a broader array of talent from the Midwest. Several efforts of this type are now being conducted in the areas of land-use analysis, environmental impact analysis, energy extension, and energy conservation. By incorporating the resources of SPEA with the institutional and inter-institutional resources available to ESAC, an effective arrangement has been made for environmental applications in research and education.

Internship Program

The School of Public and Environmental Affairs emphasizes practical experience in the student's chosen professional field. The Center for Public Affairs Service-Learning develops full-time paid internships in public agencies for the summer, fall, and spring terms. Students participating in a public-service internship project receive six hours of academic credit and a stipend.

The philosophy of the Center is that professional level work experience in a public agency is an indispensable part of the student's academic and intellectual progress. Student interns can also provide valuable services to the sponsoring agency in a cost-efficient manner. Internships provide work experience in a wide variety of areas, such as environmental planning, baseline research, environmental quality monitoring and maintenance, computer modeling of systems, environmental impact assessment, and legal, statutory and policy analysis.

The Center deals in an ongoing basis with the Indiana State Board of Health, the Louisville District Office of the U.S. Army Corps of Engineers, and over a dozen local and regional planning councils and consortiums. Federal agencies also offer opportunities for environmental studies students in summer internship programs. These federal programs are conceived and conducted by the respective agencies and are independent of the public service internship projects offered by the Center.

Internships granted through the Center for Public Affairs Service-Learning are awarded on a competitive basis. Students are chosen for interviews with sponsoring agencies who are responsible for selecting the intern. The nature of a student's academic background and the quality of his/her academic performance are often important considerations in the hiring decision.

The Office of Public Career Counseling and Placement

The Careers Placement Office specializes in placing graduates in federal, state, and local government agencies, as well as private industry. Students receive counseling on office procedure and job information. They also participate in a workshop that teaches skills in writing resumes, cover letters, interviewing techniques, and other skills involving the job search.

The Placement Office develops contacts with potential employers to determine the availability of appropriate positions and to establish necessary business relations. This service is important because some potential employers such as government agencies rarely interview candidates on college campuses.

The job notification system advises the graduate of job openings in his or her area of interest and qualification. The individual is then expected to make contact directly with the interested agency, submitting the necessary letters, resumes, and any other materials requested. Job applicants remain active in the system until the Placement Office receives a request that their names be removed. Employed graduates may elect to remain in the system for the purpose of subsequent job placement. Such clients will be expected to function as sources of job leads for others, realizing that similar leads from others may well provide opportunities for them.

The Placement Office offers a number of additional services in order to provide the maximum number of job possibilities to SPEA graduates. First, a Management Information System is being developed that will help to accurately and quickly provide the proper job matches to our clients. Second, a statewide Job Bulletin is published that lists jobs available in Indiana state, regional, and local governments. Third, an alumni directory has been published that shows where SPEA graduates have been placed in the past, and that will help new graduates establish contacts in geographic areas where they might wish to work. Finally, various programs are being developed to share employment information with students, such as Government Days and a Government College Relations Council.

Criteria of Success

As our Environmental Programs have been operational for a relatively short time, many of the usual criteria of success cannot yet be fully applied. However, in this time we believe that we have been rather successful in meeting most of our early objectives.

Student enrollments in our introductory interdisciplinary courses have been near capacity since their beginning; at present there are about 700 undergraduates enrolled in these two courses each year. We presently have 95 Environmental Studies/Policy majors in undergraduate programs. Most of our course development has been in graduate-level environmental science and policy courses, with 18 such courses being offered by SPEA and about 35 other relevant courses being given by other departments. At the present time there are 25 graduate students in the MPA-EP program and 55 in the MSES program; of these approximately 60 percent have financial assistance. The SPEA internship program has successfully arranged interesting and rewarding intern experiences for all environmental science and policy graduate students who have applied. Students graduating from these Master's programs have typically been employed in satisfactory positions within a relatively short period following graduation. Success in achieving outstanding career objectives has been especially high in the MSES program, where all of those graduating have found excellent employment or have gone on to doctoral programs in several well-known institutions. In many ways, these achievements may represent some of the best criteria of success of our programs.

In recruiting new environmental science and policy faculty, we have had a very high acceptance of offers, even under highly competitive conditions with other major universities.

In the early years of these programs, efforts were focused more upon teaching and service activities rather than upon externally funded research. During the past three years the environmental science and policy faculty have received grants and contracts from EPA, ERDA, OWRT, USGS, NSF, Fish and Wildlife Service, Forest Service, three different state agencies, and numerous private organizations. We have now achieved a quite reasonable level of funding and anticipate that our research activities will continue to expand.

ENVIRONMENTAL EARTH SCIENCES AT STANFORD UNIVERSITY

by Irwin Remson and George G. Mader*

The undergraduate Environmental Earth Sciences Program at Stanford University develops a broad environmental perspective on a foundation that includes mathematics, science and technology, and city and regional planning. Its students are urged to identify a particular environmental career goal and approach it by going on to a graduate or professional school. The most popular career choices have been city and regional planning, environmental engineering, environmental law, and geology. The cornerstone of the Program is a three-quarter, 15-credit sequence in Environmental Earth Sciences, taught by the senior author, a hydrogeologist, and the junior author, a practicing city planner. A land-planning project spans the three quarters, taking the student through the entire process from data collection to plan presentation. A Program spin-off has been a 1978 text on Geology in Environmental Planning.

Introduction

The Environmental Earth Sciences program in the Department of Applied Earth Sciences at Stanford University is based upon several principles:

1. Students should develop a broad environmental overview as well as capabilities for positive environmental action.
2. Students should develop marketable job skills.
3. A secure foundation in mathematics, science and technology is important to the environmentalist. His position should always be on firm scientific and technological ground.

**Dr. Remson is Professor of Applied Earth Sciences and Geology at Stanford University, Stanford, California 94305. His main area of academic interest is hydrogeology, and his research is concerned with the use of numerical methods in the solution of groundwater problems. His latest publication is Geology in Environmental Planning (McGraw-Hill Book Co., Inc., 1978) with Arthur D. Howard. Prof. Mader is Acting Associate Professor of Applied Earth Sciences at Stanford University. He is Vice President of William Spangle and Associates, Inc., city and regional planners. His clients include Federal, state, regional, county and local agencies. Much of his research is concerned with the inclusion of earth sciences data in the land planning process.*

4. Environmentalists must understand political, economic, legal and social constraints.

5. The domains of the users of environmental data, the planners, managers and decision makers, must be studied. It is fruitless to undertake environmental studies if the results are not put to use.

6. Anyone involved in shaping the future needs historical and philosophical perspective, a sense of aesthetic values and good taste.

7. An environmental program should provide the capabilities for deciding environmental issues; it should not advocate specific environmental positions.

The Program

The Stanford University undergraduate is required to fulfill "university requirements" in English, Science and Technology, and Social Sciences and Humanities. We believe these to comprise an inadequate socio-humanistic background for environmentalists. However, we cannot impose additional requirements in these areas because of limitations on requirements.

The program in Environmental Earth Sciences first requires the development of a firm scientific foundation. Requirements include Calculus, Statistics, Computer Science, Chemistry, Physics and Biology. A knowledge of pollution problems is imparted through a Civil Engineering course in environmental engineering. A knowledge of the Earth is imparted by courses in physical and historical geology and geomorphology and by a two-week field geology experience.

The undergraduate Environmental Earth Sciences program is pre-professional and general. The undergraduate is urged to select a specific career and plan on entering graduate or professional school. The courses that help with the career orientation are Environmental Earth Sciences I, II, III, discussed below.

Once the student's career objectives are defined, he is urged to use his undergraduate electives to further his graduate education objectives. For example, one who plans on a Civil Engineering career might use his electives for topics such as mechanics and design. Thus, at the end of his graduate training he will have Civil Engineering capabilities combined with a knowledge of environmental problems and approaches.

The most popular graduate options among our undergraduates are City and Regional Planning and Environmental Engineering. Environmental Law and Geology follow. Other students have followed careers in Landscape Architecture, Resource Economics, Mineral Economics, Business Administration, Management, Marine Management, Biology, Forestry, Journalism, Mechanical Engineering (Solar Energy), Water Resources and Architecture.

Table 1. Lecture Topics

Environmental Earth Sciences I

I. Introduction
II. Orientation to field reconnaissance topics
III. Introduction to City Planning and the General Plan
IV. A land capability system
V. Statistical treatment of environmental data
VII. Optimization in environmental decision making
VIII. Analyses needed for urban planning
IX. Weather and climate

Environmental Earth Sciences II

I. Environmental systems analysis
II. Geologic constraints
III. Planning responses to earth science topics
IV. The climatic water balance
V. Water pollution
VI. The history of cities
VII. New towns and visionary approaches

Environmental Earth Sciences III

I. General Plan preparation
II. City planning and urban design
III. Non-renewable resources
IV. Guidance of urban development
V. Solid wastes
VII. Regional and state planning
VIII. Geologic hazards

We discourage our undergraduate students from entering our graduate program in Environmental Earth Sciences. We do maintain such a program primarily for students who have not been in our undergraduate program. Those few students who have been in our undergraduate program and enter the graduate program are tracked into options with in-depth substantive studies in areas such as City and Regional Planning, Hydrogeology, Geomorphology and Environmental Geochemistry. Of course, a Special Program is available for those with innovative or unusual approaches.

Environmental Earth Sciences I, II, III

The three-quarter, 15-credit sequence, Applied Earth Sciences 130, 131, 132 — Environmental Earth Sciences I, II, III—is the cornerstone of the Environmental Earth Sciences program. It is taught by the senior author, a hydrogeologist, and the junior author, a practicing city planner. As discussed above, it helps with career decisions. It provides the survey, the perspective, and the overview. The textbook, Geology in Environmental Planning (Howard and Remson, 1978), arose from the course sequence.

The courses blend the theoretical and the practical. A field land planning project provides the unifying theme. Therefore, it is essential that the planner have experience and capabilities as a practitioner.

The lectures and laboratories develop a knowledge of the various environmental systems and techniques, and of planning and management problems and techniques. Table 1 lists the lecture topics and Table 2 the laboratories. Throughout, the emphasis is on doing and practice. We do not just talk about dissolved oxygen; the students compute dissolved oxygen for a stream and make a decision with economic consequences. We do not just talk about models of urban development; the students fit such models to local cities.

The field trips visit diverse geologic and ecologic environments. They include a tectonically-active coastal setting, an area of active landslides and active faulting, a mountain environment, and a marsh environment. They include different cultural settings, such as downtown San Francisco, suburban subdivisions, open space, and farmlands. One trip looks at projects incorporating good design of open space, at historical preservation, and at redevelopment projects. Throughout, the geologist and planner attempt to intertwine all environmental, developmental, and cultural factors.

It is noteworthy that the course sequence has no prerequisites. Yet, the students have some sophisticated assignments. For example, they solve a land-development management problem using linear programming. Several things make this possible. First, we are interested in students learning what linear programming is and what it can do in optimizing land use. It is unrealistic to expect them to understand the theory without additional course work. Second, we use canned computer programs that are simple to run. Third, we patiently hold the student's hand and

Table 2. Laboratories

Environmental Earth Sciences I

1. Use of topographic maps for planning purposes
2. Use of geologic maps for planning purposes
3. Population analysis and projection
4. Statistical projection of environmental data
5. Land use analysis in downtown areas
6. General Plan analysis

Environmental Earth Sciences II

1. Computer storage of environmental data
2. Linear programming
3. Use of multiple maps to establish planning constraints
4. Computing a climatic water balance
5. Solving a problem in environmental transport (a diffusion problem)
6. Computing dissolved oxygen in a stream for different droughts

Environmental Earth Sciences III

1. New community site selection
2. Use of airphotos and stereopair interpretation
3. Economics of mineral resources
4. Preparation of a constraints map

show him how to set up his land-development problem, how to put it on the computer, and how to interpret the result. Every single student has successfully completed this linear programming problem. Similar success has been achieved in the use of statistical regression techniques with population data and in the application of the Thornthwaite method to compute a climatalogical balance.

The Land-Planning Project

The land-planning project spans the three quarters of Environmental Earth Sciences I, II, III. It takes the student through the entire process from data collection to plan presentation. It gives the student an opportunity to put his classroom knowledge to work in the real world. Each year a different area is chosen. Howard and Remson (1978) describe such a project involving the San Mateo coastside of California.

In the first quarter, the students in groups of 1 to 3 undertake a reconnaissance. Table 3 lists the topics used for the study of Pacifica, California. They use readily-available data obtained from individuals, universities, government agencies and libraries, supplemented by field inspections. There is inadequate time for primary data collection in the field. The results are incorporated in reports and in maps drawn to a scale suitable for the project. These data are stored in the laboratory, which becomes the "planning office" during the next two quarters. Finally, the information is taken from the maps, coded and indexed using a grid, and read into computer storage.

In the second quarter, the students in groups of 4 to 6 use the computerized data, maps and reports in land-capability analysis (Howard and Remson, 1978). They begin to obtain a feel for land uses in the area and may prepare constraint maps.

The major effort in the third quarter is the preparation of a preliminary General Plan. The same student groups are carried over from the second quarter. They begin by defining their objectives, goals and standards. This exercise involves extensive discussion, interchange of philosophies and ideas, and above all, compromise. If all goes well, the serious business of preliminary General Plan preparation begins.

The preliminary General Plan includes a map delineating land use, population and dwelling unit distributions, transportation, open space, recreation facilities, commerce and industry, public buildings and centers, and other items of interest. Large-scale maps may show plans for the central business district, civic centers, typical neighborhoods, parks or special areas. Design-oriented students often prepare renderings showing the types of structures and actual appearance of developments.

The text accompanying the plan must delineate the goals and objectives of the plan. It justifies its economic, political and legal viability. The design population and design philosophy must be justified. It must have a scheme for plan implementation and indicate the governmental actions or supports that will be used.

Table 3. Reconnaissance Topics Used for the Study of Pacifica, California

Natural Physical Features

- Topography
- Climate
- Geology
- Soils
- Drainage and Sedimentation
- Hydrology
- Ocean
- Plant life
- Animal life

Man-Made Physical Features

- Land use and ownership
- Transportation
- Public utilities
- Sewage disposal
- Solid wastes

Economic Factors

- Economy

Social Factors

- Population
- Housing

Public Interest Factors

- Government and Special Interest Groups
  - Pacifica
  - San Mateo County
  - Association of Bay Area Governments
  - Metropolitan Transportation Commission
  - California Coastal Commission
  - Power structure and recent issues

Methodology and Special Studies

- Visual analysis
- The computer system

The preliminary General Plan is presented by the students to their peers just as it would be to a client. Finally, it is presented to local governmental officials on campus provided that they are interested.

Program Logistics and Support

At this writing, the undergraduate program in Environmental Earth Sciences has 45 majors. Its graduate counterpart has 10 students. Environmental Earth Sciences I has an enrollment of 60. We expect Environmental Earth Sciences II and III to have enrollments of about 40.

Environmental Earth Sciences I, II, III are the only new courses created for the program. The program support has come from the Stanford School of Earth Sciences, of which the Department of Applied Earth Sciences is a unit. It has included the support of the practicing planner as an adjunct faculty member as well as normal course and departmental expenses.

Conclusions

The program in Environmental Earth Sciences at Stanford University has been well received by the students. We estimate that 70 percent of them enter graduate and professional schools and proceed to environment-related careers. Fifteen percent go directly into environmental work and the remaining 15 percent leave for other vocations.

The students are well prepared because they combine a knowledge of the scientific and engineering with a knowledge of the socio-humanistic disciplines. It is our hope that they will be able to solve some of the pressing environmental problems that beset us.

REFERENCE

Howard, A. D., and Irwin Remson. *Geology in Environmental Planning*. New York: McGraw-Hill Book Co., Inc., 1978.

THE ENVIRONMENTAL CONCERN IN THE HOUSING AND INTERIOR DESIGN DEPARTMENT, COLLEGE OF HOME ECONOMICS, UNIVERSITY OF MISSOURI

by Kate Ellen Rogers*

The persons who initially adopted the term "environment" typically had only the natural environment in mind. Somewhat to their surprise they soon found themselves involved with persons to whom the term "environment" encompassed the man-made. By 1977 the head of the Sierra Club was even saying that the future of Yellowstone Park depends on the future of Watts. The quest for environmental quality, then, is not solely the province of schools of natural resources. It is of equal concern to schools of architecture and related professions, represented here by a department of housing and interior design in a college of home economics at a large mid-continent landgrant university. Its students are asked to acquire an appreciation of human and environmental needs as a context for wielding the tools of design. Recent department projects center around energy conservation research and education.

Introduction

The major objective of the Department of Housing and Interior Design is that of providing a quality education for those people in the State of Missouri who are interested in design as it pertains to the sociophysical or man-made environment. It is a professional design program providing the student with the tools and skills to operate effectively and competently. The educational program is designed to broaden an individual's perception making possible a creative seeking of solutions to environmental design problems. Major research findings and applications that have meaning for environmental design are a part of freshmen through senior courses being primarily in those courses mentioned below. The particular departmental concern is the design of the near environment—housing and interior design.

**Dr. Rogers is Professor and Chairman of the Department of Housing and Interior Design, University of Missouri, Columbia 65201, and has been a member of that faculty since 1954. Her book, The Modern House USA, was published by Harper and Row in 1962. Dr. Rogers has been active nationally in the American Society of Interior Designers, the American Association of Housing Educators, American Home Economics Association, and the Interior Design Educators Council, having served the latter organization as President and Chairman of the Board. She has been active in the Foundation of Interior Design Education and Research, serving on the Accreditation Committee and is presently chairman of the Standards Committee. She has been editor of the Journal of Interior Design Education and Research since 1975.*

The Department of Housing and Interior Design is in the College of Home Economics and has four sister departments—1) Child and Family Development, 2) Clothing and Textiles, 3) Family Economics and Management, 4) Human Nutrition, Foods and Foods Systems Management, as well as curriculums in Journalism and Education. The major goal of the College, its departments and programs centers around the development of professionals who can improve the quality of living at individual, family group, community and state levels. Major emphasis is placed on interactions among subject areas, research, resident instruction and extension staff and between faculty and students at all levels. (1975-76 Annual Report, College of Home Economics, University of Missouri.)

The housing and interior design program is built on a simple hypothesis: that the functions, activities and aspirations of individuals and families can be supported by the design of their living spaces and that design must be based on an understanding of human values, behavior, cultural and social factors and an understanding of the interaction of these with the physical environment.

The educational program is an effort to integrate this premise with the more traditional tool areas of design education. These are basic design, construction, materials, methods, systems, communication skills, as well as orientation to the design profession, design history and design theory.

It is held that students taught in such an integrative program will be more responsive to human needs and aware of human social structures, organizations, and their relation to physical space. It is further theorized that such students will be able to work with professionals from other disciplines such as economics, sociology, anthropology, psychology, engineering and architecture in team efforts to solve the environmental problems of our communities and personal living spaces.

Such a program could be designed to span ten to fifteen years or a lifetime. We have four years and hope that some of our students will dedicate their own lifetimes. There are two major parts in the baccalaureate program.

The Baccalaureate Program

General Education Courses (45-48 credits)

The courses provide students with a background in humanities, arts, and sciences. Some specific courses in sociology, psychology, economics, and mathematics are required.

The Professional Program (70-75 credit hours)

There are six areas in the professional program: 1) basic and creative development, 2) design planning and analysis, 3) history of art, 4) architecture and interiors, 5) communication skills and technical knowledge, 6) family and environmental studies. Students take courses in each of the areas. Specific numbers of credit hours and courses are required in each area. Non-required courses are listed in each of the six areas from which students may select additional work to make up the required number of course credits.

While all of the courses may be said to address the program's central intention—design of the near-environment—some are major to that intention. Two are lecture courses and five are studio courses. These courses will be given a more detailed discussion in this paper.

Basic Creative Development Area (18 credit hours required)

Principles of Environmental Design (3 credit hours)

1. Overview. This course is taught each fall and winter semester. It is a lecture course. It is the first course in the program and it is recognized that few of the 150-250 students who take it each semester will have developed an awareness of environmental design or a view of the relationships and interactions between man and his environment.

2. Objectives of the Course.

    a. Acquaint students with roles and bases of design and develop cognitive awareness.

    b. Develop awareness of the dynamic interaction of environment, ecology and design.

    c. Develop an aesthetic and critical analysis of design in contemporary and historic settings.

    d. Develop awareness of current social, political and aesthetic issues affecting the environment and its design.

    e. Develop awareness of the context and role of the designer in our society.

3. Lectures make use of films, slides, records and filmstrips. There are a number of guest lecturers during a semester. Visual materials cover conservation and destruction of nature and environment; regional planning and design; public art and architecture; consumerism, fine arts and design; historical developments of environmental styles; social and technological influences on design. There is aesthetic analysis and criticism of contemporary and historical design covered throughout the course.

4. Assignments.

Required projects include a newspaper notebook composed of articles relevant to the three major topics of the course, environment, ecology and design, with personal editorial analysis and statements, a visual notebook presenting visual likenesses among disparate photographs and also depicting the elements of design in nature and the environment. Special papers are required discussing and integrating phases of the term's work. There is a required daily class notebook, summaries of which are submitted for grading at the end of the term.

Paralleling this course, the students take a two-dimensional design course and a three-dimensional design course. In each course there is a final assignment that has environmental implications. Over the past several semesters the assignments have been graphic wall designs for actual academic spaces, lending color and interest to dull wall areas in this University. The three-dimensional class has constructed interesting tree houses for nursery schools and kindergartens in the community.

Design Planning and Analysis Area (18 hours required)

Residential Interiors (3)

1. Overview. The course enables the student to analyze the social environment of an individual or family and to design an interior to meet the needs of the inhabitants. The student must be able to clearly present his/her design, including the plan, the furnishings and the accessories.

2. Objectives of the Course.

    a. To develop an understanding of the physical, social, economic, and aesthetic needs of human beings related to interior design as shown in consistent patterns of human behavior and routine activities.

    b. To develop an understanding of the interior spaces, their functional relationships and circulation patterns in relation to human needs.

    c. To develop an understanding of the art elements and principles of design in the selection of the furnishings and in the organization and personalization of interior spaces for human beings.

    d. To develop a basic knowledge of furnishings (furniture, accessories, wall and floor coverings as well as window treatments) with emphasis on design, construction and materials. Cost and durability are also emphasized.

   e. To develop skills in presenting design proposals via floor plans, elevation and models.

3. Projects include the following steps in the design process:

   a. Identification of design objectives.

   b. Identification of user needs and requirements via the research of literature.

   c. The design of plans and models.

   d. Presentation and analysis of proposals presented to peers, faculty and clients. The final project is a proposal for an actual family or individual who meet with the students.

Architectural Design I

1. Learning about people and houses

   a. Value studies related to housing, socio-economic status, and family life cycle are discussed.

   b. Interviewing a "client" and organizing expressed needs into compatible activity zones for the home.

2. The research of technical information needed to design the home.

   Floor plan details, lighting and wiring specifications, plumbing, heating, cooling, and basic wood construction are subjects for this studio course. The students learn how to draw floor plans, elevations and how to read and draw plot plans.

3. Design information based on student research.

   The students translate "client" values and needs into floor plans and consider the space requirements for activities that take place in and around the home. Zones, buffers, traffic patterns, lighting, exterior design and the relation of house to site are major design problems.

4. Projects

   a. The design of an efficiency apartment or small home for a single resident or a beginning family is assigned. The solution must have a description of family characteristics, values, needs, a floor plan and a basic furniture arrangement. The traffic pattern and lighting plan are major areas for studios design and critique.

   b. A small to medium home for a growing family is assigned. This project may include some limitations of industrialized housing; i.e., 12-14' width units to be transported.

Students may be assigned another student as a "client" to interview and then the student writes up family descriptions, characteristics, values and needs. The laboratory problem results in a solution which must include a floor plan, basic furniture arrangement, lighting plan, elevations and a plot plan.

c. Several different final projects are used to give students a choice: teams are assigned to design cluster homes, duplexes, fourplexes or townhouses; a home designed for a development with one basic floor plan and four possible exterior treatments and sites; or the design of modular units that can be used to build homes with many different floor plans. An actual client interview is also included. The design solution must include a description of the project, the family or group, their characteristics, values and needs, a floor plan, a basic furniture arrangement, a lighting plan, the elevations, and a plot plan, which must be presented as students' solutions.

5. Quizzes and Exams

Student evaluation is determined by critique of the design solution. Quizzes cover course material from readings and lectures.

Residential Interiors II (3)

This course is a continuation of Residential Interiors. The projects are a series of design-client assignments with emphasis on business procedures and presentation.

Architectural Design II (3)

The student is presented with a variety of public building types which demand rigorous solutions to the requirements of circulation, relationship of different human functions, and the relationship of the building to its environment. Also intended is an increased awareness of the nature of materials and simple structures. Emphasis is placed on the development of an aesthetic plan derived from the expression of functional requirements.

The student must demonstrate an effective problem solving attitude. One aspect of this skill is to be able to independently analyze and define the problem and the designer's injection of design experience and knowledge of human behavior. A second feature of problem solving is the development of a more free and less rigid approach to a design problem. The student investigates several alternative schemes to achieve more flexibility in the final design solution.

The projects undertaken have included schools, banks, club houses, and buildings for special people, such as elderly or handicapped.

Contract Design II (3)

The course concerns advanced problem solving in multiple spaces in the public environment. Special emphasis is on the client-designer interaction, programming (data gathering, analysis, evaluation and writing design program), development of design concept, decision making, presentation and specification writing. The contract market and its resources are studied and visits to showrooms arranged. Aspects of professionalism as to practice and ethics are discussed and professional attitude is developed. Two or three studio problems are undertaken each semester. These include offices, hospitals, and libraries, and are given in a sequential order of complexity.

Family and Environmental Studies (9 hours required)

Housing Fundamentals (3)

The course relies heavily on film documentary of environmental issues related to housing, such as population, land use, poverty, public policy, preservation, conservation, building technology and projections of the future. One paper is required using census data and a second paper is required on a housing problem area. Field trips are planned to a series of selected sites that parallel the concerns of the class. Class discussion and lectures revolve around the housing laws, housing problems, research related to the problems, and evolving methods of solution.

Other courses in this area are concerned with human development, financial management and world nutritional problems.

Supportive Departmental Courses

There are also problems, readings and research for advanced and graduate students. A recent problems course taken by two graduate students was the design of the maximum security unit, St. Louis County Jails. They consulted with the architects, prison superintendents and the St. Louis extension specialist and they were able to present their solution in model form for the cellblocks, hallways, and security bars to the prison board. The proposal was accepted. Two-thirds of the semester had been spent in interviewing, reading and in review of pertinent research on prisons.

Supportive University Courses

In addition to the courses outlined above, other courses are available at the University to strengthen a particular interest that a student may have. Sociology, psychology, economics, statistics, art, art history, landscape design, engineering, and business are areas that students usually use.

A visiting lecture program is integral. Interior designers and architects are often asked to critique the students' projects. Social scientists on campus have been generous in speaking before classes and in accepting membership on graduate committees. Since 1972, outstanding representatives of the rapidly developing groups, called environmental psychologists, environmental designers or environmental researchers, have been guests of this department, inspiring both faculty and students.

Degrees

The department offers both the Masters and the Ph.D. in addition to the Baccalaureate. These degrees are based in design, but advanced courses may be taken in related fields appropriate to the individual's accepted research proposal. Man's closest environment—where he lives, develops and works—is worthy of close study and research. It may be viewed in historical terms, or as a theater of social relations, or as a physical space with which man interacts, or as a structural problem to be solved through building technology, or as an area of increasing government concern. However it is viewed, it is an area where high interdisciplinary involvement is not only appropriate, but necessary if solutions are to be found.

This department hopes to develop individuals who are competent, with sufficient skills and broad perspectives, and able to work with other individuals and disciplines in the solution of environmental problems.

The description of the courses appearing in this paper have been adapted from course material prepared by the individual teachers.

Research

Research is supported by departmental funds with limited support from outside sources. Most of the funds support graduate assistants. Over the past three years environmental research interests have centered around the following problem areas:

1. A study of housing adaptation in a suburb built ten years ago. Exterior and interior evaluations were made and community records reviewed. A diagnostic evaluation method was used to study housing structure and family adaptations. (Masters)

2. A study concerning the prediction of relationships between structure and human behavior in environmental design. The user study is being conducted in a county hospital in a small community in Missouri. The original design of the interiors was completed by students in this department five years earlier. A diagnostic model is being used to investigate the effect of the design decisions. (Ph.D.)

3. A study of University-owned family housing apartments to determine "utility" or desirability of certain physical features in relation to behavioral and aesthetic preferences. This user analysis will include the development of a rating scale that may be useful in future construction. (Ph.D.)

4. A study of energy efficiency as related to housing—a major concern with the "natural house" through the use of existing technology in home construction and modification. The study resulted in a set of teaching slides and was funded by the Rural Development Program in Missouri. (Masters)

5. A study of interior environmental adaptations for energy conservation of the early 19th century and the suggested uses for modern homes. This resulted in a set of teaching slides and was partially funded by Missouri Extension. (Masters)

6. A study of the attitudes and characteristics of elderly people on fixed incomes concerning the implementation of energy-saving techniques in their homes. A proposal has been submitted for funding. (Ph.D.)

7. A study of the standards and guidelines used in the voluntary accreditation of four-year interior design programs. The study is being partially funded by the Foundation of Interior Design Education and Research. (Ph.D.)

8. A study of the degree of familiarity involved in the selection of chairs for use in the home. (Ph.D.)

9. A study of contemporary housing in Israel with concerns as to type and availability, design and construction technology including solar energy uses. A set of slides is being developed. (Masters)

10. A study of the historical origins of existing pre-colonial Spanish housing of the Southwest. (Ph.D.)

THE ENVIRONMENTAL COMMUNICATIONS MASTER'S PROGRAMS AT THE UNIVERSITY OF WISCONSIN—MADISON

By Clay Schoenfeld and John E. Ross*

Environmental communication may be said to encompass the process of planning, producing, and disseminating, or conducting research related to, written, spoken, and/or pictorial messages about the environment, environmental issues, and/or environmental management. Environmental communicators seek in various situations and ways to encourage public awareness of environmental problems; public understanding of underlying principles, issues, and options; and a public commitment to individual and collective action. The University of Wisconsin-Madison has assumed a significant role in the graduate training of environmental communicators. Strong departments of journalism are associated with equally strong departments in the fields of environmental studies and management. A variety of local, state, and federal environmental agencies and organizations offer internship experiences. A Center for Environmental Communications and Education Studies serves as a facilitator. Out of this cooperation have emerged three different yet complementary Master's degree emphases in Environmental Communications. In their ten years of operation, the cooperative programs have graduated 60 professional students who now occupy positions in the mass media, with government resource management agencies, with environmental organizations, in resource industries, in colleges and universities, and in environmental education centers. As a concomitant of the instructional regimen, student theses and faculty papers have contributed to advancing knowledge at the point where communication process and environmental content impinge.

Fittingly enough, the evolution of the University of Wisconsin-Madison's Environmental Communications Programs stemmed from newspaper stories by what today would be called an environmental reporter. Russell Lynch, writing in the Milwaukee Journal in 1961, severely criticized the University for its "lack of commitment to conservation education." Responding to the charges, the then President, Conrad A. Elvehjem, appointed a distinguished faculty Committee to "consider the leadership role of the University in the field of conservation education." The Committee, first under the chairmanship of Dean Lindley Stiles of the School of Education and later of Prof. Robert A. McCabe of Wildlife Ecology, concluded that the University did indeed need "an expansion of focusing of its many and worthwhile contributions to conservation education." To do so

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the Committee recommended that "an instrumentality act as coordinator for an interdisciplinary, intercollege approach to conservation education."

Resulting faculty legislation authorized a Conservation Education Office with a part-time coordinator. The Office became operational in March, 1966, with modest funds provided by the then Chancellor, Robben Fleming. In 1969, after completing its initial assignment to "help encourage and facilitate broad programs related to conservation teaching, research, and extension on the part of the widest possible range of departments and schools," the Office sharpened its focus to become The Center for Environmental Communications and Education Studies, implementing a thrust foreshadowed by several prototype theses in the 1940's and 1950's.

The Center is an informal consortium of faculty and students, from a number of UW-Madison departments, devoted to the professional training of specialists in environmental communications, to studies of environmental communications media and methods, and to producing related publications, educational symposia, and outreach services. A major mission is aiding cooperative Environmental Communications Master's Programs.

The Programs in Outline

The purposes of the Environmental Communications Programs are (1) to identify a group of young men and women with an aptitude for environmental communications; (2) to enhance their ability to help translate ecological concepts into public action, and (3) to prepare them for positions in what might be called the environmental communications "ecosystem"--communications media, government agencies, voluntary organizations, resource industries, and educational institutions, formal and informal.

The academic sequences of the Programs are designed to meet the advanced-training needs of students with varying backgrounds yet with common aims: (1) the communications major or practicing journalist lacking courses or field experience in environmental studies, (2) the environmental studies major or resource manager lacking courses or field experience in communications, and (3) the person with some general background or experience in both fields, but no professional orientation.

While the focus of the Environmental Communications work at UW-Madison is on the professional Master's degree, undergraduate students may develop a concentration in environmental communications by selecting appropriate electives. Graduate students desiring to go on for a Ph.D. in preparation for college teaching, environmental administration, or research may qualify through interdisciplinary Land Resources Mass Communication, or other programs.

The Areas of Concentration

It must be emphasized one does not get a degree in Environmental Communications per se at UW-Madison. The degree is offered in one of several established Master's sequences, while lending to them an environmental communications emphasis. The three principal participating program areas are:

The Department of Agricultural Journalism. With a long history of training specialized communicators, the DAJ offers a regimen of at least 24 credits, to include a research paper or thesis on some aspect of environmental communications.

The School of Journalism and Mass Communication. According to a recent survey one of the leading centers of mass communication scholarship in the country, the SJMC offers two tracks for environmental communicators. One, with an emphasis on public relations, involves at least 24 graduate credits and a thesis. The other, with an emphasis in specialized reporting, involves at least 30 graduate credits and a major publishable work.

Programs in Resource Planning and Management. Because of the UW-Madison tradition of interdisciplinary programming, it is possible for a qualified student to work our a minor in environmental communications while taking his or her degree in such fields as ecology, soils, forestry, landscape architecture, environmental monitoring, agricultural economics, or urban and regional planning. The arrangement is recognized particularly for majors in the special programs of Land Resources, Recreation Resources Management, and Water Resources Management.

Admission to Environmental Communications graduate work at UW-Madison is based on undergraduate GPA, GRE scores, a statement of purpose, field experience, and letters of reference. Requirements vary among the participating schools, departments, and programs. If a person does not have an undergraduate major in the sequence of choice, he or she will be asked to make up certain deficiencies. Normally admission is limited by the participating departments to a combined total of about ten students a year. Varied forms of financial support are available to EC graduate students: national scholarships, University fellowships, department research or project assistantships, teaching assistantships, affiliated internships, and special awards. The number and nature of such aids vary from department to department.

The Curricula

There is no one curriculum in Environmental Communications at UW-Madison. At the outset the student must meet all of the normal requirements for the Master's degree in the school, department, or program of choice, including satisfying whatever are the required prerequisites. Within that framework the student fashions an appropriate emphasis in consultation with a faculty advisor. In general the advisor will want to see the student build on his or her past academic and work experience to develop a net program that will represent a balance among the sciences, the social studies, and communications--all focused, of course, on the interpretation of environmental issues.

Which school, department, or program is chosen as "home" will depend on the student's academic qualifications, professional goals, natural bents, preference for major professor, and, perhaps, on the relative availability of support funds. Whatever Master's degree sequence is followed, the student can select appropriate elective courses from an extensive campuswide inventory, and be eligible for three integrative educational experiences the Center for Environmental Communications and Education Studies helps arrange:

Environmental Management 300, a 3-credit inter-college survey course designed to broaden awarenesss of environmental problems, deepen understanding of environmental principles, and stimulate involvement in environmental policy formation.

Environmental Communications Directed Study 699, 1 to 2 credits of individualized work in current literature, a professional field, or an eco-action project.

Environmental Information and Education Programs 860, a 3-credit proseminar focused on the theory and practice of activities aimed at enlightened public participation in resource planning and utilization.

The Center

The parent Center for Environmental Communications and Education Studies is unique in the country as a convener and catalyst for University scholars devoted to instruction, investigation, and outreach in a variety of fields concerned with interpreting environmental issues to many publics. The Center's strength is in its organizational ties with functioning colleges, schools, and departments on the UW-Madison campus, and with key faculty members and students. Its Executive Committee includes the Deans of the Schools of Education and Natural Resources, the Director of the School of Journalism and Mass Communication, the Associate Director of the Institute for Environmental Studies, the Chairmen of the Departments of Continuing and Vocational Education and Agricultural Journalism, and representatives of the Department of Curriculum and Instruction, Land Resources, Water Resources Management, and Recreation Resources Management Programs.

The Center itself is not primarily an operating agency. Its role is to identify promising avenues of endeavor, outline pilot programs, and then work itself out of a job by encouraging other appropriate agencies to take over. Hence the Center's past activities consist of developments it has helped get off the ground, in the 1966-1973 period particularly. Among the more significant were the following:

Professional Environmental Communications Programs. While individual students had always been able to work out independent majors, prior to 1966 there were no formal professional training programs at Madison designed to produce environmental interpreters. Today such programs are strong components of the work of appropriate schools and departments. The Center provided a rallying point by developing the proseminar in Environmental Information and Education Programs.

General Studies in Environmental Management. Prior to 1966 there were few interdisciplinary programs in environmental studies at Madison. The Center contributed to their evolution through (a) developing the intercollege course in Environmental Management, (b) helping draft the working paper that became the charter for the Institute for Environmental Studies, (c) participating in structuring the School of Natural Resources, and (d) advising Water Resources Management students.

Environmental Communications and Environmental Education Research. At the suggestion of the Center, the School of Education's Research and Development Center for Cognitive Learning incorporated environmental education investigations in its repertoire, and UW schools and departments of journalism assumed national leadership in investigating the role of the mass media in environmental policy formation.

Environmental Extension. In 1966 environmental programs as such were not on the agenda of University Extension. From $5500 in seed money supplied by the Center, environmental public service programs have now grown to where they occupy one of the major Extension thrusts.

"Environment Wisconsin." In its early days the Center attempted to function as a point of contact among public and private environmental agencies and organizations. This catalytic role led to the formation of a free-standing center, known as Environment Wisconsin, supported entirely by contributions, and free to engage in public debate as a consortium of eco-activists.

State Office of Environmental Education. The Center drafted the document which led to a Gubernatorial proclamation establishing a State Environmental Education Council, a State Environmental Education Advisory Committee, and a State Environmental Education Coordinator. The Center also wrote the proposal which won for the Office a USOE planning grant. The Office is now a part of a Wisconsin Environmental Council.

State and Federal In-Service Training Programs. Pilot state in-service training institutes in environmental education and pilot federal in-service training institutes in communications for environmental management, sponsored by the Center, have led to a range of related programs under the aegis of appropriate agencies.

Referral Agency. In its early days the Center was one of the few campus instrumentalities with an environmental tilt to its name, so merely by being so listed in telephone directories the Center became a referral agency for all manner of questions from inside and outside the University. That role has long since largely been assumed by the Information Office of the Institute for Environmental Studies, although the Center's latest publication is a utilitarian Guide to Environmental Information in University of Wisconsin-Madison and Other Madison Area Libraries and Reading Rooms.

National Environmental Education Act. The Center drafted the original working paper, "Toward a National Strategy for Environmental Education," which became translated into Public Law 91-516, under the leadership of Senator Gaylord Nelson of Wisconsin and Congressman John Brademas of Indiana.

The Journal of Environmental Education. Perceiving a need for a particular new means of information exchange, the Center put together the pilot issue of a professional journal devoted to research and development in conservation communications. The Journal is now published quarterly in the private sector with the continuing counsel of the Center.

National Seminars. Under the aegis of the Center, seminars on aspects of environmental communications teaching and research have been built into the 1977 and 1978 conventions of the National Association for Education in Journalism. Earlier the Center was instrumental in arranging a forum on the public relations of wildlife management at the 1973 North American Wildlife and Natural Resources Conference, a forum that eventuated in the monograph, Human Dimensions in Wildlife Programs.

Products

While the Center continues its broad role of stimulation and facilitation, albeit with increasingly limited funding, its primary mission remains providing a focus for the graduate training of environmental communicators. In the ten years of the Programs' existence they have graduated 60. Where some of the original graduates are now is a clue to the contribution of the Programs to the study and practice of environmental communications:

Public information director, New England River Basins Commission; public information staff, American Chemical Society; professors of journalism at Colorado State, Kansas State, Western Washington State, University of Washington, UW-Stevens Point, and Humboldt State; public information officer, Wisconsin Department of Natural Resources;

superintendent, Great Smoky Mountains National Park; wildlife management area manager, Wisconsin Department of Natural Resources; executive director, Society of American Travel Writers; environmental editor, Smithsonian Institute; public relations officer, Trane Environmental Engineering Company; chief of communications, Urban Land Institute; writer-editor, USDA Forest Service; publications chief, Wildlife Management Institute; public affairs officer, U.S. Fish and Wildlife Service; program coordinator, Wisconsin Environmental Council; environmental education coordinator, Carnegie Museum of Natural History; interpretive naturalist, Wehr Nature Center; and senior editor, *National Wildlife*.

Thus it can be seen that the UW-Madison Environmental Communications effort prepares people for the modest yet measurable opportunities for well-qualified journalists turned manager-scientist or talented manager-scientists with a communications bent. "These intergrades in human anatomy are perhaps more important than those which so perplex mammalogists and ornithologists," Aldo Leopold once wrote. "Their skulls are not yet available to the museums, but even a layman can see that their brains are distinctive."

Research

As a concomitant of the instructional program in Environmental Communications, student theses and faculty papers have contributed to advancing knowledge at the point where communication process and environmental content impinge. A number of such works have led to published monographs or articles in books, journals, or proceedings.

Principally under the leadership of Professor Scott Cutlip, a cluster of studies has sought to draw modern lessons from past public relations practices on the part of early conservation leaders. Levin (1973) documented the conflict that arose between Gifford Pinchot and the Congress over his multi-media efforts to build up the U.S. Forest Service. Wittwer (1973) examined a landmark event in the history of conservation and PR, the 1908 White House Governor's Conference. Fischer (1973) detailed how Stephen Mather sold the Park Service idea. And Schwartz (1973) looked at a state-level conservation crusader at work, Ernest Swift.

Related researches represent case studies of the role of communications in current environmental management policy formation. McCabe (1973) followed the flow of environmental information in a successful campaign to save a small marsh. Klessig (1973) distilled a battery of lessons in communications for eco-activists from a successful drive to halt a particular environmental threat. Madigan (1973) identified new publics in the spectrum of a state conservation agency.

Principally under the leadership of Professor Ross, basic research has sought to trace evidences of association between environmental communication systems and public environmental attitudes and behaviors, particularly involving environmental controversy (Ross, 1973). In a pioneer paper, Ross (1967) had related technical knowledge and the use of pesticides. His early study with Stamm (1966) had indicated geographic, social, and political concerns may override the level of conservation knowledge in public positions on a resource management issue. Stamm (1972) went on to develop fundamental theories about environmental attitudes and the media that may help form them. Bailey (1973) looked at a knowledge gap between the public and the media. Moore (1973) identified a gap between public comprehension and commitment to change. Eisele (1973) found discrepancies between what biologists think duck hunters know and want and what their actual postures are. In a controlled experiment, Evrard (1973) was able to raise duck hunter perceptions. Beane and Ross (1974) found the media halting in informing the public on nuclear power plant issues. Smith (1971) evaluated impacts of visitor information activities in a representative National Forest, a study that was twice replicated (1975). Witt (1973), himself a student of environmental communications research, did the field's first annotated bibliography, and an essay on environmental media and methods in perspective. Recently Ross (1977) has elucidated ethical issues in environmental policy formulation.

Several studies have looked at the calibre of conservation media and messages. Marler (1973) tested various approaches to an anti-litter program in National Forest campgrounds. Clausing (1973) traced the evolution of an ecological message in outdoor magazines prior to 1968. Belak (1973) replicated the study in the 1968-70 period. Evison (1971) explored adapting new communication technology to National Park interpretive programs.

Among other papers, Schoenfeld has written on educating the public about natural resources (1968), the ecology of the new conservation (1971a), the anatomy of the environmental movement (1971b), the eruption in environmental communications (1972), interpreting environmental issues (1973a), environmental information as a phenomenon (1973b), future careers in environmental journalism (1975a), the ecology of resource report writing (1975b), environmental mass communications problems and promises (1975c), the environmental communication "ecosystem" (1976), the role of the mass media in environmental education (1977a), markets for environmental feature articles (1977b), and environmental education for wildlife conservation (1977c).

Recent studies in press include Donald R. Zimmerman's examination of the dynamics of information interplay and environmental awareness in a small town, and Robert J. Griffin's analysis of characteristics of environmental reporters on daily newspapers nationwide.

Theses not abstracted in scholarly journals but that resulted in useful end-products have included an ecological guide for four-wheel-drive recreationists in the Sonoran Desert, exhibit designs for environmental topics, a case study of fund raising on the part of a small environmental organization, an analysis of waterfowl hunter attitudes toward the use of non-toxic shot, an evaluation of an environmental education center, studies of industry propaganda on power plant issues, the production of environmental films, a case study of information techniques on the part of a citizen-action group, an evaluation of a household-energy game, books on tundra peregrines and woodland ecology, an interpretive booklet for Isle Royale National Park, a study of state conservation magazines, studies of information flow in land use planning situations, a content analysis of general-circulation magazine environmental coverage, a junior-high ecological anthology, studies of environmental-motivation messages and technical weather information, examinations of the role of the news media in the passage of environmental legislation and successful citizen-coalition projects, a guide to the collection and cataloguing of fugitive environmental literature, a teacher's handbook for Platt National Park, a study of media use of state conservation department news releases, a visitor's guide to a nature center, and media background packets on selected environmental issues.

In Summary

In our society, enlightened resource management for environmental responsibility depends to a great extent on an aware, informed, understanding, and active public. To a significant degree it is professional interpreters of environmental issues who help form the public attitudes and actions that are at the heart of identifying environmental problems and arriving at solutions in keeping with ecological principles, engineering capabilities, esthetic values, and economic wherewithall.

Growing national programs of resource management for environmental responsibility depend increasingly on regional and local initiative. Environmental communicators help provide sound educational materials and adept counsel on the public relations of environmental housekeeping. They help lay a basis for environmental action by clarifying the choices in land and water use, by relating them to viable values and social objectives, by preparing people for constructive change, and by interpreting practical guidelines to the emergence of a national ecological conscience.

UW-Madison's Environmental Communications Master's Programs look to a future devoted to generating compelling theories of content and methodology, disseminating new concepts and materials, bringing to practitioners an identity with the growing edge of research, bringing to researchers the needs of the field, providing budding communicators with rigorous instruction and association with fellows; in short, to helping sponsor a new profession.

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THE EDUCATION OF A GENERALIST: THE UNIVERSITY OF CALIFORNIA—SANTA BARBARA EXPERIENCE

by A. H. Schuyler, Jr.*

Some date the dawn of modern environmentalism from the odious Santa Barbara oil spill in January 1969. It was certainly a striking "media event." But some professors and students didn't have to watch the tube to get the message. The University of California-Santa Barbara was within sight and smell of the littered channel and its beaches. Reaction was rapid. Within weeks 21 broadly representative faculty formed an ad hoc committee to attack the twin problems of disciplinary "reductionism" and the "mind pollution" that lie at the root of environmental problems. By the fall of 1970 an environmental studies program was in being at UCSB—one of the first of the new sub-species. Eight years later the UCSB program remains remarkably true to its charter: a liberal arts process for generalists, not disciplinary training, administered as a multidisciplinary program, not as a department, striving for a "proper tension" between faculty borrowed from the sciences and the humanities, with no illusions about evolving graduate-level offerings. The stake of the liberal arts in environmental education has had no more effective spokesman than UCSB's Rod Nash, although he now personally questions the viability of a program that gives its products no marketable specialty to accompany a general environmental literacy. The country will watch the directions UCSB takes under a new director now being sought.

Environmental Studies at the University of California at Santa Barbara came into being as the result of many influences: the call for relevance by students, the obvious pressures of the environmental crisis of the late sixties, and the demand from the citizenry that the university deal with some of the problems of society. In retrospect however, it becomes clear that a most powerful influence, although by no means the most obvious, was the deep seated dissatisfaction with the divisive nature of the university. Many thoughtful faculty were disturbed over the ever-increasing compartmentalization of intellectual activity at UCSB and the tendency of departments to withdraw into themselves, making little effort to communicate with other disciplines. Environmental Studies at Santa Barbara began as an attempt to create a general liberal

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**Like most environmental studies faculty, Mr. Schuyler was educated as a specialist: B.S. in chemistry from Caltech and M.S. in biology from UCSB. After fifteen years in high school teaching and administration, he returned to UCSB to work for a Ph.D. with Garrett Hardin. He joined the Program as a teaching assistant for two years and then became a lecturer. For the last three years he has been chairman of the Environmental Studies Program, UCSB, Santa Barbara 93106. His principal research and teaching interests are in energy policy and the dangers of tanker traffic.*

arts education which, through pure chance of time and location, used the environment as a focus.

John Crowell, a geologist, and one of the first co-chairmen of the Environmental Studies Program, preserved the various committee minutes and reports that eventually brought the program into being. These records show that it all started on February 18, 1969 when a group of twenty-one faculty calling themselves The Friends of the Human Habitat met to discuss the possibility of promoting some form of environmental education at UCSB. They were old pros and young turks united by concern for the environment and a desire to improve university education. Many were geologists, but there were also geographers, engineers, biologists, an economist and a historian. Two of the group, Garrett Hardin and Preston Cloud, were already nationally known for their writings on the environment.

They met in tense and disturbed times. Platform A had blown less than a month before and spilled crude oil could be seen on the beaches and smelled in the campus air. Comments like this by a senior appeared often in the campus newspaper:

> "It gets pretty depressing to watch what is going on in the world and to realize that your education is not equipping you to do anything about it."

Citizens, oil companies and officials were all calling on faculty, especially biologists, for opinions on what to do about the spill and its effects.

The "Friends" considered these demands and ideas and questions and by the end of the academic year faced several options. The geographers felt that their discipline was the most appropriate one to take on the whole province of environmental studies, but they were not strong enough to command much respect from the older departments. The geologists proposed a College of Environmental Studies while the historians, led by Roderick Nash, pushed for an interdisciplinary department or program in the College of Letters and Science. Many of their ideas came from an article by Kenneth Hare (1970), "How Should We Treat Environment," in which he pointed out several very important ground rules for any group attempting anything new in the university:

1. In the university nothing can be easily done for either the first or the last time.

2. All vested interest groups such as departments or institutes will regard any new enterprise as a threat.

3. Traditional faculty groups may fight like cats and dogs within the clan but they quickly close ranks when asked to step outside the clan.

4. Action-oriented programs that purport to solve social problems are regarded with grave suspicion by most academicians.

Also, the Santa Barbara campus had an additional and special local problem in that it had only grown into a university from a teacher's college in the last fifteen years. It was most unsure of itself and very cautious about innovations that might mar its evolving scholarly image. Add to these constraints the fact that the Santa Barbara campus in the winter and spring of 1970 was a hotbed of student revolt. The Bank of America had burned in Isla Vista and two men lost their lives in the unrest. Strange, hastily-conceived courses on almost anything were being offered and a grade could be earned by demonstrating little more than an expression of concern. Faculty were urged by a few to dismiss their classes and allow students to earn grades through "experience"!

The Friends of the Human Habitat had evolved into a chancellor's ad hoc committee to plan the formation of Environmental Studies. Tribute must be paid to this committee; it resisted the temptation to throw quickly together a program that would appeal to the hysteria of the times, and when the Environmental Studies Program started in the fall of 1970 its administration was sound and its philosophy clear. Special mention must be given to then Vice Chancellor Gordon MacDonald, who later left UCSB to become a member of the President's Council on Environmental Quality. In the Administration he was the prime mover for environmental studies.

What follows are the ground rules of Environmental Studies at UCSB. Viewed from the vantage point of eight years of operation they show great foresight—and perhaps a dash of luck.

I. Environmental Studies is a liberal arts education for the generalist. It educates its majors to have a holistic view of the environment and to appreciate the contributions that all disciplines and professions can make to the identification and solution of environmental problems.

II. It is not in competition with the established disciplines. Its graduates must be able to communicate with the specialist and to know when to call on them but never to consider themselves, in a given area, equal in knowledge to the specialist. This point was emphasized over and over again to reassure the traditional disciplines that we were not a threat, we were not in competition. As Roderick Nash put it, "We are a process that brings all disciplines to bear on environmental problems."

III. It is education, not training. Quite by chance, its core curriculum became valuable as preparation for environmental impact analysis in the middle 70's when the California Environmental Quality Act and the National Environmental Policy Act called for impact statements on all projects. But this was as much serendipity as planning.

IV. It never claimed to be preparation for graduate work in the conventional disciplines. It has, however, worked out to be a sound foundation for graduate work in the professions of law, planning, journalism and education.

V. As a program rather than a formal department, it is administered by the Dean of the College of Letters and Science who appoints an interdisciplinary committee to direct its policy. The everyday administration of the program is handled by the chairman of that committee, and in the first four years was administered by co-chairmen Rod Nash, professor of history, and John Crowell, professor of geology. It can be thought of as a protege of all of the departments whose faculty contribute toward teaching its courses. As a program it poses no threat; as a college or department it might have.

VI. The program encourages its students to belong to environmental groups, to campaign in local politics and to take stands on environmental issues. However, as a unit of the University of California, it has been scrupulous about not taking stands or lending support to any advocate groups. In the early years of the program, many students were strongly displeased with this detached and scholarly attitude but anything else would have killed the program quickly.

VII. No one, faculty or off-campus professional, has ever been asked to teach in the program without proper compensation. Many early environmental studies programs relied on volunteer instruction and when the first flow of enthusiasm wore off, found themselves with no faculty.

VIII. We tried to strike a good balance between breadth and depth. The Environmental Studies major takes six preparatory courses that cover many disciplines—biology, chemistry, geology, meteorology, geography, hydrology, economics, history, sociology, political science. The eight courses for the major may come from eight different disciplines and cannot, in any case, have more than two courses from one field. On the other hand, to give depth, the concentration must be five courses from one discipline. In the last few years an increasing number of students are extending the concentration to a second major; we expect almost 30 percent of our majors to be taking a double major in the eighth year of the program.

IX. We term ourselves interdisciplinary but in actuality we are multidisciplinary. Emmelin (1977) defines interdisciplinary as the interaction of two or more disciplines ranging from simple communication to complete mutual interaction over a wide field. Multidisciplinary is simply the juxtaposition of various disciplines with no apparent connection between them. After eight years we are tired of belaboring this point and now, with some discussion in the senior seminar, leave it to the student to pull it all together and to discern how disciplines can or should communicate.

X. The basic philosophy of Environmental Studies at Santa Barbara is multidisciplinary education for the generalist. It is synthetic, not reductionist education. It implements what Bode, et al. (1949) refer to as "The education of a scientific generalist." The product

> would be a person of exceptional breadth of appreciation in the sciences; we extend their appreciation to the humanities and social sciences as well.

A judicious dose of statistics will provide a concise history of the program's progress. In 1970 the program offered three lower division courses, hired seven faculty on a part-time basis and had perhaps 800 students enrolled in those three courses. In 1972 there were 21 graduates of the program and about 100 declared majors. As we start the eighth year there are about 400 declared Environmental Studies majors, a number we have held for the last four years. Under the Environmental Studies label, twenty-six faculty instruct in thirty courses. As of June 1977, there have been 502 graduates of the program.

What other measures of success are there? We received, in 1971-73, a $60,000 no-strings-attached grant from General Electric Foundation, that enabled us to set up many new and experimental courses. Some of the experimental courses were successes and we have continued to support them; others failed but we were glad to have had the chance to try them out. Our financial support from the College of Letters and Science has grown each year and is now quite adequate for the size and kind of program we operate. Departments that were highly skeptical of our value and who viewed us as a fad that would be gone by 1975 have recognized us and offered to teach courses for us. We have been able to attract visiting professors of renown such as John Platt and Ezra Mishan. We estimate that over 75 students a year transfer to our program from other colleges, universities, and junior colleges. Very few majors leave the program.

Of course the most critical measure of success is our students, their attitudes, opinions, and careers. Through planning, and perhaps luck, our curriculum has arrived at a proper balance of depth and breadth. Students appreciate the wide range of subjects that can apply to the major and also the coherence that comes by tying them into an environmental framework. Many have said that for the first time they saw purpose to diversity. We believe we have found that proper "tension" between science and the humanities. Scientifically-inclined students will comment that they now realize why economics and history are important. Similarly, many who have been turned off by science are now attracted to it by their interest in the environment—an interest that may initially have been aroused by studies in ethics or sociology. A few quotations from student letters will reinforce these views:

> —I feel ES can offer perhaps the most relevant and comprehensive interpretation of human history and of modern issues of our species. I think we should reject and resist any attempt to make it a specialty—rather give it the intellectual status and dignity such a study deserves in a liberal arts institution.
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> —Studying several general topics in ES gave me a background for deciding what I would like to go into deeper.

—You might mention to people who doubt the department's credibility that I have yet to regret in any way getting my degree in Environmental Studies. The broad science background has proven surprisingly useful; most companies are glad to teach you the specifics.

—Since I deal with a variety of issues, ES was good in giving me a wide substantive background.

—My own feeling is that undergraduate education should aim to produce competent human beings rather than merely competent specialists. With the gradual demise of general education requirements, it seems that those interdisciplinary programs like Environmental Studies assume a place of added importance on campuses as large as UCSB. Even as I have moved into more specialized work, I like to feel the ES background has helped prevent the affliction of academic tunnel vision.

—The most meaningful framework for functioning in the current world situation on all levels—personal to international.

—I think the broad spectrum of insights has allowed for a true process to be attained for attacking problems. I've learned how to learn.

—Even nuclear physicists at the Livermore Lab complain that they were needlessly narrowed in grad school and had to learn all the details of their actual work after landing the job anyway.

The question most often asked about Environmental Studies is "What can you do with it?" Two years ago we started to collect data on our graduates so we could objectively answer that veiled skepticism. The results, published in an Alumni Directory (1977), support our belief and hope that there is a place for the generalist in our society. A questionnaire sent to 393 graduates of the program from June 1972 through March 1977 generated a surprising and heartwarming 80 percent response. We also inquired by phone or postcard the plans of our 111 graduates of 1977 and had 60 percent response from them. Our four questions were these:

1. What did you think of the program?
2. What suggestions have you for improving it?
3. What jobs have you held?
4. What graduate schools did you attend?

Favorable opinions of the program have been well sampled in the previous paragraphs and quotes. Basic criticisms were that the program was too broad and not rigorous enough. Some graduates suggested more math, economics, and field-oriented courses. There was strong support for the second major, and, as previously mentioned, we do encourage it. Many of the suggestions have since been put into effect.

Two hundred and forty-one of our respondents reported that they were gainfully employed. The majority considered their work satisfying and in many instances connected with the environment. Twenty-nine work in planning at many levels and another twenty-nine are specifically employed to do environmental impact analysis. Eighteen teach and twenty-one work all or part time as park rangers and naturalists. Eleven work in solar energy and fifteen are connected with public or private environmental groups. Some are in business for themselves as landscape architects and gardeners, boat builders, artisans, carpenters, freelance photographers, and at least three have set up their own environmental impact consulting service. A sampling of employers includes the EPA, the Federal Power Commission, Stanford Research Institute, the Sierra Club, Los Angeles Water and Power District, California State Energy Commission, the Norwegian Ministry of Environment, and planning agencies at all levels. And as in any group of college graduates in these times, we have some who are waiting on tables or doing manual labor. There were mixed reactions about the value of environmental studies for getting jobs:

> --I'm very pleased to have achieved a degree in ES. I also never intended my ES degree to provide me with easy access to jobs.

> --If I sound bitter, I am, because I feel like I was shoved out of a factory for students without a real practical application of my education and a lot of far-fetched ideas that could not be put into practice. Possibly the ES degree is best as a minor, giving a more general education to the specific training of the geologist, chemist, biologist. But as a major, the only alternative is grad school.

> —I would be especially interested in what the many environmentally aware "failures" are doing—the waitresses, clerks, etc.—there must be lots of us.

> —I believe as you, Barry, and others have said that to find employment with an environmental degree, you must create your own job or 'carve your own niche,' because the business world has not yet recognized the need for people with such a background and consequently have offered no positions for persons with environmental degrees.

> —Poor preparation for work, but then 90 percent of the college majors have nothing to do with job preparation—they are primarily mind-expanding exercises.

> —As preparation for career, the ES program fails only because it has not committed itself to that purpose—the program was aimed at a generalist education in training a well-informed citizenry. I took the program for that reason. I had no illusions about it being a stepping stone for a career—that next step is up to the student.

One hundred and twenty of our graduates have gone on to graduate school. Law leads the list with twenty-three, then comes planning with twenty-one. Fourteen have gone for credentials or advanced degrees in education. Only four have gone for advanced degrees in environmental studies, but then, there are not many opportunities to do this. Each of the following fields have been entered by one to three graduates: architecture and environmental design, business, civil engineering, environmental communication, environmental management, journalism, landscape architecture, marine resources, paralegal, para-medical, photography, systems dynamics, sanitary engineering, wildlife management, religious education. Some with double majors have gone on in history, economics, biology, botany and geography. Fifteen have stayed at UCSB for their graduate studies and the great majority have scattered to universities and schools in California. Twenty-five have gone out of state to such places as the Universities of Michigan, Alaska, Washington, Oregon, Hawaii and Denver and to private universities such as Dartmouth, Yale, and Harvard. Without exception those who wrote back describing their graduate education commended the Environmental Studies curriculum as excellent foundation for graduate work—principally because they had been given a wide range of resources in many areas. The law students have been particularly enthusiastic saying that they were ahead of most of their fellow students in knowing where to go for information and how to learn quickly about new subjects.

This short account of our program should end with a critical look at the past, present and future of Environmental Studies on this campus. In the past seven years we have realized many of the plans set out in 1969-70. We are firmly established and recognized and, as far as we can ascertain, the faculty and administration regard us as here to stay. We have made a real contribution to communication between the disciplines and have certainly advanced the cause of generalist education.

A College of Environmental Studies never materialized; in fact, we may never even become a department. Two years ago the Dean of the College of Letters and Science polled the chairmen of the fifteen departments that have cooperated with us to get their opinion as to whether or not Environmental Studies should change from a program to a department. No compelling reasons were advanced for changing; many felt that departmental status might take away from our important function in promoting interdisciplinary communication. As a program we are to some degree the dependent and the responsibility of all departments. Accordingly most take a certain pride and interest in our career. As a department we would be just another competitor.

The word "intern" never appeared in all of the deliberations and committee reports that led to our founding. However, the internship program has been one of our most successful enterprises. Starting with two interns in the fall of 1971, we now regularly place about forty interns a quarter. Under faculty supervision, these students work for academic credit in local agencies, schools and organizations. Some go far afield in full-time internships in San Francisco, Sacramento, Washington, and Alaska. Several of our interns have obtained full-time employment as a result of their internships. For example, we have graduates with the EPA, the National Park Service, and the Sierra Club. For all the interns the experience provides a real world glimpse of possible careers and, to some extent, provides a type of employment experience to put on the resume.

When Environmental Studies was being founded, the National Environmental Policy Act had just been passed, and the California Environmental Quality Act had not yet appeared. No one appreciated what the need would be for men and women trained to do the environmental impact statements called for by NEPA and CEQA. When the demand came in 1972-73, we were beseiged with requests for people to do this work and we started a sequence of courses to train students for impact analysis. The sequence, given by two lecturers who are themselves professional environmental consultants for state agencies, has continued to be given and its students have done well in the field of planning and impact assessment.

No graduate program has appeared in Environmental Studies, though the founders have projected there would be one in five years. The administration and some of the environmental studies faculty are not yet convinced that environmental studies is a separate discipline that can support scholarly graduate work and we do not have the resources to mount a graduate professional training program for a degree in environmental impact analysis. The latter possibility has been discussed and it might be feasible in a few years. However, many of us view the costs to undergraduates of providing the benefits of graduate work as high, and we are determined to give first priority to undergraduate instruction.

Much of our instruction is given by lecturers and we are just beginning to establish the notion of tenured positions in Environmental Studies. It was hoped in 1970 that many faculty could be appointed in Environmental Studies but fears that the program might not last prevented this.

The administration still prefers the concept of a joint appointment and gave a stamp of approval by letting us appoint an assistant professor of geology and environmental studies. This has been a successful appointment and we have every expectation that the professor involved will receive tenure soon and establish a pattern that other departments will follow. At present however, the concept is still being tested and watched with reservations.

After five years as co-chairman or full chairman, Roderick Nash went back to teaching and research. I came into the program in its third year to help with teaching and administration and I took over as chairman with the expectation that we would be able to appoint, within a year, a distinguished scholar to head the program. The search proved far more difficult than we thought. Although there have been numerous distinguished applicants, we need a man or woman who is at once a good administrator, an expert teacher and a scholar of high enough reputation and productivity to hold a tenured joint appointment with Environmental Studies and another department. We are still looking.

The future direction of Environmental Studies depends on the outcome of this search. The new chairperson will take the program down paths strongly influenced by his or her own discipline and ability to command respect from other faculty and to obtain grants. It is very unlikely, though, that the search committee for this chairperson will consider anyone who is not committed to the idea of undergraduate education in environmental studies. We do not expect, for example, to shift to training in environmental sciences. We will continue to work with ideas and ethics as being fundamental to the cause of environmental awareness. Roderick Nash put it well:

> "Ideas are the keystone. They leave their mark on the landscape just as surely as chain saws and bulldozers. Machines, after all, are only the agents of a set of ethical precepts sanctioned by the members of a particular society. The most serious form of pollution is *mind* pollution. Environmental reform ultimately depends on changing values. The responsibility of higher education is clear."

We are proud of two accomplishments. Our 500 graduates who will, in various degrees and ways, affect the environment positively as citizens, educators, politicians, parents, businessmen and officials, is one. The other is the quiet conviction that we helped pioneer an important and exciting academic undertaking, the return to an education that is synthetic in nature and that promotes the generalist view.

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A LIBERAL ARTS MODEL FOR ENVIRONMENTAL EDUCATION: ENVIRONMENTAL STUDIES AT ST. LAWRENCE UNIVERSITY

by Alan M. Schwartz*

It was relatively easy for most large, diversified universities to respond to the environmental era, compared at least to small liberal-arts colleges. Most of the latter faced the challenge of growing faculty and student interest in a context of strong disciplinary boundaries and increasingly tighter academic budgets. Some responded swiftly with jerry-built "environmental programs" that were programs in name only, being merely a smorgasbord of existing courses. Others slowly evolved more sound academic programs for the decision-makers of tomorrow's society. This is the case history of one college that has gradually developed a meaningful regimen of serious undergraduate inquiry focused on environmental problem-solving, all in a classic liberal-arts setting.

The first Earth Day in April, 1970, signalled the first time the entire nation's attention was focused on the problems of our natural environment. It was only logical that it was the university community at the forefront of this movement; it was in colleges and universities where the expertise needed to understand environmental issues resided. However, when examining the historical roots of Earth Day 1970, it quickly becomes apparent that the movement was brought about by a broad coalition of experts from various disciplines. It was led primarily by students and a few notable professors, such as Ehlrich, Commoner, Hardin and others.

After the carnival-like atmosphere of the day dissipated, the student interest in environmental concerns continued to grow, not only in the form of extracurricular protests, but as a desire to incorporate the study of environmental problems into the college classroom. The response from the university sector varied as widely as student interests. Many campuses found one professor who was interested in the environment (it seems to have most often been a biologist or geologist), and man-environment courses sprang up like mushrooms after a rainstorm. Because these courses were attempts to relate to the student's growing concern for the despoilation of the earth, and because they were usually developed without much institutional commitment, they tended to focus on the disciplinary interests of the faculty member that taught them, with minimal efforts to focus on an interdisciplinary problem-oriented approach.

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The establishment of individual courses was not the sole response of the university community to this new student interest. Those few institutions that had the requisite human and financial resources developed entire programs to bring about the transition of the earth day carnivals to serious, interdisciplinary inquiry into complex problems of the environment. The University of California at Santa Barbara put together an exceptional program under the leadership of Dr, Roderick Nash. The University of Wisconsin at Green Bay focused its entire curriculum toward an environmental approach, and new colleges such as Evergreen State and Huxley College, which were specifically designed to address complex interdisciplinary problems, led the way in environmental education.

Most colleges in the nation experienced similar growth of student interests, yet did not have the resources to make the kind of commitment made by Santa Barbara, nor did they have the advantage of a new college in which to implement new programs. Most faced the challenge of growing faculty and student interest in a context of strong disciplinary boundaries and increasingly tighter academic budgets. One of the most unfortunate responses to this set of circumstances was to develop environmental programs that were really programs in name only. The man-environment course was the core, and students could choose from a smorgasbord of "environmental courses." In reality, however, the environmental courses were the same introductory biology taught for the last two decades, with a new two-week unit in environment -- a history course that spent two lectures on Roosevelt's role in America's conservation movement, etc. The social sciences were almost always relegated to minor roles. Program developers were mostly natural scientists who viewed environmental problems as extensions of conservation issues, even though it was already clear that economics, and political science and policy perspectives, were essential truly to understand any environmental issues.

Another response of higher education to the new environmental era was to produce environmental technicians. Here, a considerable effort was made to train graduates of two-year and four-year colleges to handle the new skills needed in environmental monitoring, water testing, etc. These programs have filled a very important niche in the era of increasing student demands for relevant education and skills.

Perhaps the most important role of higher education in responding to the "environmental movement" was that made by the many colleges and universities which slowly evolved sound academic programs in the liberal arts setting. These institutions, whose numbers have been growing, are the breeding grounds of the decision-makers of tomorrow's society. Like a productive estuary, they will in the future, as they have in the past, provide both the stock of individuals for specific graduate level environmental programs, and a more substantial number of individuals who, although not specifically holding jobs in environmental areas, are the decision-makers in government, industry, and business communities. Their decisions will have the greatest impacts on the environment.

In the remainder of this paper I will present specifics concerning attempts of one such liberal arts institution, St. Lawrence University, to develop a meaningful program of serious inquiry focused on environmental problem-solving. I believe this model is significant because it is applicable to colleges who have neither large financial resources for an entire new program nor the desire to create "catalog" programs without a meaningful institutional commitment.

St. Lawrence is a small, private, non-denominational college in northern New York. Chartered in 1856, it provides its 2200 students with a rural setting for a quality liberal arts education. The aims and objectives of the university set the tone for its academic programs—it recognizes that a liberal education requires breadth, depth, and integration in learning. In keeping with this well-established view of a liberal arts education, the goal of the Environmental Studies Program was clearly defined as one of strengthening the integration component that is so often the weakest link in colleges today, without substantial sacrifice to depth of learning that characterizes many interdisciplinary major programs. Another key element in the mission of the university is a strong commitment to the region of northern New York; thus it seeks to derive maximum benefits from the educational opportunities presented by the rural "North Country" while providing service to that region. The St. Lawrence model, then, is predicated on its size, location, aims and objectives, and fiscal constraints.

The program development, initiated in the late 1960's, had a good start with a committee of faculty from the natural sciences, social sciences, and humanities providing direction as to the best way to incorporate environmental concerns into the liberal arts framework. From its inception, therefore, the program benefitted from its broad definition of environment. With this approach, the term "environmental studies" emerges at St. Lawrence with goals distinct from the goals of narrower environmental science programs at other institutions. The primacy of the integration component of the program gave rise to its "interdisciplinary" rather than multidisciplinary nature. In 1973 the U.S. Environmental Protection Agency stated "miltidisciplinary refers merely to gathering the information of the disciplines. Interdisciplinary means proceeding from the basis of an integration of the knowledge at hand, avoiding temptation to subjugate other disciplines to support one's own specialty."[1] As in many small colleges, however, the faculty with the most interest in developing new programs were the same ones over-extended in their own disciplinary interests. For several years, ideas, directions, and potential merely simmered, until someone was funded to provide the time and responsibility for implementing first an interdisciplinary course, and then a program of courses.

Where is such an interdisciplinary beast, thrust into a disciplinary institution, to be housed? This question received considerable attention in the formation of the program. The resultant decision to create a program external to the department structure was the first major decision to insure potential success of a truly interdisciplinary environmental program. Programs which are housed within a department tend to acquire the orientation of that department, while other disciplines are relegated to auxiliary positions within the program. This tendency also poses some difficult questions concerning the director or coordinator of an environmental program. It takes an exceptional individual to take on the schizoid role of director of an environmental program and teaching member of a department; at the same time, full-time commitment to an interdisciplinary program brings with it the problems of estrangement from the well-established criteria of the university reward structure, namely tenure and promotion. A group of individuals led by Keith White enumerated many of these problems at a 1972 national conference on environmental studies programs in higher education. The group concluded that "the academic home for an interdisciplinary program cannot be within a traditional department, but must be outside, and of equivalent stature, with respect to budget and voting privileges."[2] The St. Lawrence program was developed in concurrence with this position, along with other recommendations of White's group, e.g., a representative peer group for evaluation, strong administrative support and understanding, and budgetary commitment.

The Program Development

The Environmental Studies Program is the first entirely interdisciplinary area of study at St. Lawrence and is geared toward providing students with a broad-based understanding of the complex nature of today's environmental problems, within a liberal arts framework. Since the inception of the first course in 1973, five years after studies were begun, the program has taken advantage of the University's proximity to the Adirondack Mountains and the St. Lawrence River to foster comprehensive study of rural environmental issues, both inside and outside the classroom. The Environmental Studies curriculum has incorporated a North Country regional emphasis into its courses, with a continued commitment toward utilization of the unique resources which surround the University. The Program has itself become a resource to the surrounding area, with faculty and students going into local communities and providing assistance in research and planning projects. The comprehensive interdisciplinary approach to the study of environmental problems has contributed to a broadening and strengthening of the total curriculum at St. Lawrence, and it offers students an excellent opportunity to integrate diverse academic experiences.

There are many means of evaluating the success of a program, and certainly one measure is the expanding faculty interest and involvement that has characterized the evolution of the Environmental Studies Program. Faculty release and program development funds have enabled 15 percent of the entire St. Lawrence faculty, representing two-thirds of all disciplines, to participate in the Program through instruction in the team-taught introductory course and/or the addition of new

Environmental Studies courses within their departments. In three years, the Program has developed 22 course offerings, including ten full semester courses offered jointly with seven departments.

Several methods were utilized to build departmental interest and provide the necessary time for faculty to develop new courses. The first method of purchasing faculty release time was an excellent way to begin a program and develop support, but one that would probably be too costly to continue for any length of time. Interested faculty were "purchased" for one year by the Environmental Studies Program to develop and teach new courses relating their own disciplinary interests to environmental problems. They also participated in a team-taught seminar course in Environmental Impact Analysis. Each faculty member spent two-thirds of his time teaching for Environmental Studies, and one-third in his home department. In return, the disciplinary department was given sufficient funds to hire a full-time replacement. Thus the department gained, not only from additional teaching capability in terms of the number of potential offerings, but also from temporary new expertise to offer areas of study that were not normally available to departmental majors. The most important factor was that is was the permanent faculty member who developed the Environmental Studies course. Thus, after the St. Lawrence University faculty member returned to his or her department, the newly developed environmental courses continued to be offered jointly by the department and the Environmental Studies Program.

After building a core of courses in this manner, the Program further expanded disciplinary courses by awarding faculty small grants to develop new areas of interest. In this manner, new courses were added to both the department and Environmental Studies curriculum, with mutual benefits. In addition, the Program's liberal budget for library acquisitions was aimed at strengthening disciplinary holdings in areas where environmental concerns were strong.

The resulting curricula yield a core of interdisciplinary courses taught by the Program Director and new Assistant Director, and a large number of courses offered jointly with departments. The faculty assigned exclusively to the Environmental Studies Program is not expected to grow beyond the two individuals needed to teach core courses, direct student research, and coordinate the program.

The Environmental Studies courses deal with such areas as land use, water quality, energy, environmental impact analysis, etc. Many courses are issue-oriented; they are not, however, "cause"-oriented. Students are propelled toward objective study and research, in order to integrate all components of complex environmental problems. Disciplinary courses (i.e., courses which carry credit under both Environmental Studies and major departments) deal with such areas as environmental law and politics, sociology of the environment, resource economics, philosophy and the environment, and the history of American thought on nature and environment, again illustrating the Program's strong ties to disciplinary study.

The methods of Program development reflect not only the Program's philosophy of relating the interdisciplinary study of environmental problems to strong disciplinary links, but also its desire to provide a supportive, nonthreatening atmosphere in which departments may become involved. It is essential in the formation of any program such as Environmental Studies to build relations with departments and utilize existing resources. Not only is the era of increasing academic "add on" programs over, but indeed, the resources for a sound environmental program are already at most colleges; they must simply be cultivated, nourished, and incorporated into a thematic program. Thus, the role of the Director of a successful interdisciplinary program is not unlike that of the Dean of The College in orchestrating various components toward a shared mission.

The Research Component

The Environmental Studies Program at St. Lawrence offers students many opportunities for first-hand exposure to environmental problem-solving and research. Internships play an important role in the Program. Individual students have worked closely with many diverse agencies, including the U.S. Soil Conservation Service, County Planning Boards, Regional Planning Boards, The Adirondack Park Agency, New York State Legislative Committees, and the New York State Department of Environmental Conservation. The internships are not merely a reward of academic credit for work, but attempts to integrate classroom learning with practical problems. To successfully complete the internship, the student is expected to draw upon both theoretical and cognitive aspects of his or her classroom experiences. Although the primary purpose of the internship is thus to extend the liberal arts experiences of the classroom, the practical experience gained by students and the enhanced qualifications for future employment are not overlooked. The College Placement Council in the mid-1970's reported that approximately 75 percent of employers who hired new liberal arts graduates would hire more of these graduates if they had done "co-op or other experiential work."[3]

Individual and class projects also provide research opportunities, while relating to the North Country environment. An extensive water quality study of a local lake and its drainage basin at the request of the local Chamber of Commerce, an environmental impact statement for a small drainage project in neighboring Franklin County, a directory of environmental services for St. Lawrence County residents (which was published by St. Lawrence County), an Environmental Resource Center for area school teachers, and a study of Lake Placid's preparation for the 1980 Winter Olympics, highlight the Program's accomplishments to date. As the research component of the Program becomes more clearly defined, an increasing number of students have displayed efforts of high enough caliber to provide them with material for publications and presentations at professional meetings.

The Role of Environmental Studies In The Total Curriculum

One of the hardest questions for the St. Lawrence Program and perhaps other programs as well is, "Where does Environmental Studies fit in relation to the rest of the curriculum?" The options are numerous, and include having environmental courses as supplements to the total curriculum with no status as a program, having various numbers of environmental studies courses as one component of a major program, with a specified number of disciplinary courses also being required, and having environmental studies as a major unto inself, like traditional disciplines. The choice of options depends on one' educational philosophies and should incorporate aims and objectives of the institution. Although my own educational philosophy would be broad enough to include the Environmental Studies major or true generalist, the unfortunate reality is that hundreds of students graduating with majors in these programs have unrealistic ambitions. Although some Environmental Studies background may be essential for a liberally educated doctor, lawyer, or voter, a generalistic major with no area of disciplinary concentration (how many courses are necessary to be considered a concentration is an open question) shuts out many future options for students, including most graduate programs and many "environmental" careers. Indeed, when one completes an environmental studies major that is, for example, a combination of a full economic major and a substantial number of environmental courses, one has to explain his credentials carefully to avoid being classed as "the typical Environmental Studies major with no skills or expertise." Educators must work toward informing prospective employees and graduate programs about the advantages of looking beyond disciplinary labels, but it is in any case still going to be in the student's best interest to have some level of expertise in a particular discipline.

Our program allows students to form their own majors by taking at least four courses in two or three areas (Environmental Studies may be one of these) and supporting the application for this major with evidence demonstrating that the particular courses chosen result in an integrative academic program. The second option, called a combined major at St. Lawrence (a coordinate major at some other institutions), requires in-depth training in one discipline and a substantial number of environmental courses that best integrate with the discipline. In general, fourteen to sixteen courses are required for such a major program. The combined majors to date have been instituted in Environmental Studies-Biology, Environmental Studies-Economics, Environmental Studies-Government, Environmental Studies-Geology, and Environmental Studies-Sociology.

Summary

The Environmental Studies Program at St. Lawrence University has grown in four years from two courses to twenty-two. It offers courses jointly with seven departments, and includes at least ten traditional disciplines in its introductory course work. It is problem-focused region-focused program, that offers research opportunities to facilitate a serious interdisciplinary inquiry into environmental problems. Its success has been from its support in all levels of the University community, e.g., students, faculty, and administration, and also from its independent position outside the traditional departmental structure, and the integrative nature of the program with the existing departments. Interdisciplinary education is not cheap, and to maintain a quality program we will have to maintain a budget that not only provides for the operation of the program on a day-to-day basis, but also recognizes the need for continued faculty development in new areas. Indeed, although not discussed in this paper, the potential for better utilization of under-utilized tenured faculty in interdisciplinary programs becomes a major benefit during times of decreasing enrollment now being experienced by many institutions with new interdisciplinary programs.

Our program is not without its problems, but the model of shared courses and shared faculty, with direction from a small number of people responsible solely to the Environmental Studies Program, is attractive to faculty, students, and administrators today, because it is possible with relatively minor reallocation of existing budgets, and relatively little in the way of new appropriations. With all of these positive attributes, the model is sure to become even more attractive in the future.

FOOTNOTES

1. U.S. Environmental Protection Agency. The Quality of Life Concept. U.S. Government Printing Office, 1973.

2. Herscher, W. J. and Cook, R. S. Environmental Responsibility in Higher Education: Processes and Practices. University of Wisconsin, 1973, p. 43.

3. The College Placement Council, Inc. Four Year Liberal Arts Graduates. Bethlehem, Pennsylvania, 1975, p. 3.

EPILOGUE

Readers will certainly appreciate the significance of this volume. That significance stems not from whatever window-dressing the editors have supplied, but from the utilitarian substance, revealing insights, honest assessments, and, yes, vaulting philosophy inherent in the component case studies. Collectively they provide a window, not only on the evolution of higher environmental studies themselves, but on the workings of that phenomenon, the modern university—at once responsible for great academic traditions and responsive to public needs.

THE CAPACITY TO CHANGE

As custodians of our culture, universities understandably are loathe to change their configurations with any dispatch. There is still to be found on any campus, alive and well, the vestiges at least of the trivium and quadrivium that were all there was when the higher learning came to the New World.

But universities can and do change. As society's font of new knowledge and new knowledge-seekers, they must. Only so short a time as 100 years ago, a single individual professed natural philosophy. Today he is represented even in the mother arts and science college by whole battalions of faculty arrayed in companies made up of platoons broken down in squads, as it were. From the mother-college disciplines have sprung in turn batteries of mutant breeds in the applied sciences and professions; from biology, for example, limnology, agronomy, horticulture, wildlife management, microbiology, genetics, ecology, entomology, and so on, and on. Hastened by the landgrant college concept, the modern university has come to be both a reflection and an engine of a vibrant society.

We see in environmental studies one of the most recent manifestations of the dynamic nature of the university. Perceiving new, or at least renewed, environmental problems not wholly amenable to attack by existing configurations and curricula, the university has fabricated new, or at least remodeled, approaches and instrumentalities, yet without dismantling its basic order. In turn, changing university enterprise has stimulated political if not social change in the patron community.

It is this vital entente between public university and university publics that is the very essence of the higher education today, and we have watched the story come to light clearly in these case studies.

THE SCOPE OF CHANGE

It is striking the way in which the case studies in this book have sprung from such a wide range of disciplines and professional schools, as attested by the academic backgrounds of the authors. Represented are one or more ag extension educators, architects, artists, biologists, chemists, civil engineers, ecologists, economists, elementary teacher educators, entomologists, environmental educators, foresters, geographers, geologists, historians, home economists, journalists, landscape architects, lawyers, limnologists, meteorologists, music educators, outdoor educators, philosophers, physicists, poets, political scientists, public administrators, sanitary engineers, science educators, social studies educators, sociologists, soils scientists, statisticians, systems engineers, zoologists. No doubt if the leaders of all environmental studies programs could be identified, scarcely no discipline or school would be unrepresented. Perhaps under no other rubric does a specialist in general pedagogy from Murray State's modest environmental education program in Kentucky commune with a research ecologist from the University of California-Berkeley's sprawling School of Natural Resources or with an organizational theorist at SUNY-College of Environmental Science and Forestry.

It is likewise striking the depth to which environmental studies concepts have penetrated the academic structure—wholly new instructional curricula and organizational arrangements at the undergraduate level, wholly new master's degree programs, wholly new cross-discipline Ph.D. research arrangements, wholly new extension configurations. While in some cases the changes may prove to be more cosmetic than surgical, there is no doubt the impact of environmental studies will long be in evidence on the broad physiognomy of the campus. In these case studies alone we find programs based in the disciplines of the arts, botany, chemistry, ecology, economics, geography, geology, history, limnology, meteorology, philosophy, physics, political science, sociology, and zoology; in professional schools of agriculture, architecture, education, engineering, forestry, home economics, journalism, law, public administration, urban planning, wildlife management; and in custom-built specialized centers, liberal arts faculties, multidisciplinary institutes, outreach instrumentalities.

Environmental studies know no geographic barriers. From Florida State's unique work with community leaders, and the Cook College-Rutgers novel program in international environmental studies, through the great heartland Schools of Natural Resources at Ohio State and Nebraska, to the specialized ECO-Education program at San Francisco State, environmental studies have made their imprint on colleges and universities everywhere, public and private, large and small.

The history of higher education offers few such examples of so widespread, rapid, and deep a response to changing public needs and pressures within an overall framework of responsibility for academic standards as that represented collectively by these varied case studies.

THE NATURE OF CHANGE

As the case studies herein have suggested, in keeping with the significant diversity among institutions of higher education, the programs or instrumentalities of environmental studies that have emerged at universities in the past ten years are not carbon copies of each other. Each tends to be indigenous to the traditions, missions, and ethos of a particular campus. Withall, our case studies have revealed certain what might almost be termed remarkable similarities among types of environmental studies enterprise continent-wide.

History

As Gatherum (1977) rightly points out, "Many of the activities that relate to conservation (and conservation education) in the United States occurred long before the 1950's . . . People were very aware of environmental problems and the need to effect adjustments." Van Hise's seminal Conservation of Natural Resources text dates from 1910, for example. Also Aldo Leopold was writing so early as 1933 that "economic criteria did not suffice to adjust men to society; they do not now suffice to adjust society to its environment . . . Civilization is a state of mutual and interdependent cooperation between animals, other animals, plants, and soils, which may be disrupted at any moment by the failure of any one of them."

Yet, in the late 1940's when three prescient books appeared, they disappeared with what seemed at the time no trace of real impact: Fairfield Osborne's Our Plundered Planet, William Voigt's Road to Survival, and Aldo Leopold's Sand County Almanac. Collectively the authors viewed with alarm a rampant growth of heedless technology, and called for a new "ecological conscience" if the world were to be saved for human grandchildren and "goose music." If anybody listened, the campuses largely did not. At the time they themselves were apostles and examples of growth and development. Besides, hadn't Resources for the Future, Inc., just announced that the only thing we had to fear was fear itself?

Just below the surface of ebbulient university affairs, however, there were emerging individual faculty and students with a growing concern for a collapse of environmental quality and resource quantity they thought they could project. Depending on their disciplines, their points of departure were invariably the threats posed by what would come to be called the four P's: population, pollution, pesticides, and people.

By the late 1950's and early 1960's prototype environmental studies professors and their acolytes were beginning to identify themselves in publications, public hearings, and informal seminars.

Gersper (1977) has an interesting slant on this evolution of environmental education. "Conservation," he says, "prevailed for a long time as a popular movement before its message was incorporated into academic and professional programs at universities and colleges. Environment, on the other hand, began academically as ecology safely ensconced in university biology departments, and then burst out into the popular environmental movement and reappeared in colleges in new and different forms."

Etiology

Except where a few environmental studies programs sprang overnight to full flower in new universities, environmental studies have had strikingly similar upbringings.

On a typical campus there emerged, as we have said, a cadre of professors with shared environmental concerns. Invariably they were relatively senior staff with impeccable reputations in their respective disciplines, secure in the power structure and free to pioneer. They organized as an ad hoc committee to propose university departures. In due course they were institutionalized as a center, group, program, or some other such rubric in, but not of, the existing hierarchy of departments, schools, and colleges. The funding was tenuous, the in-house reward system non-existent. Young assistant professors joining the configuration lived hazardously in terms of merit raises and promotions. Gradually the university formally recognized the instrumentality in one way or another, although the adaptation may have been accompanied by some blood on the floor.

Taxonomy

The resulting genus environmental studies has three principal species. On the one hand there is the program with an emphasis on undergraduate teaching. A sub-species in turn presents environmental studies as the new core of a broad liberal arts-and-sciences education for responsible citizenship, typified by the University of California-Santa Barbara's "generalist" curriculum, which took shape in the shadow of the infamous 1969 oil spill. A second sub-species offers environmental studies as a technical preparation for certain careers in environmental control, as at Kentucky's Morehead State University; in environmental interpretation, as at San Francisco State; or in environmental teaching, as at The Ohio State University-Newark. The two sub-species may inter-breed, as in Stanford's Environmental Earth Sciences Program, whose graduates head for advanced work in planning, engineering, geology, and law.

A second principal species of environmental studies focuses on multidisciplinary professional master's work in conventional or exotic fields associated with varied aspects of environmental management. A sub-species tends to give products of the environmental sciences a social viewpoint, as in the Environmental Health program at the University of Kansas, enrolling science majors and engineers. Another sub-species exposes students of the social studies to technical subject-matter, as in the University of Georgia's work with majors in social studies education. These sub-species also inter-breed, as in the University of California-Berkeley's Energy and Resources Group, the environmental communications programs at The University of Wisconsin-Madison, and the University of Pennsylvania's National Center for Energy Management and Power.

The third species of environmental studies takes its impetus from interdisciplinary research applied to societal needs, and develops custom Ph.D. programs to hand-tool the new breeds of scientists called upon to investigate new approaches to new knowledge. Some such programs are rooted in the biological and physical sciences, as in the University of Virginia's Department of Environmental Sciences; others in the social sciences, as in Indiana's distinguished School of Public and Environmental Affairs; others in the professions, as in Missouri's School of Home Economics.

Virtually all elements of the genus environmental studies are characterized by a concern for the affective or value dimensions of the field beyond its cognitive demands, epitomized by Waterloo's Man-Environment Studies curriculum or Notre Dame's courses in philosophy. All elements are likewise conscious, to greater or lesser degree, of an outreach, adult education, or public service mission, however defined, characterized by the University of California-Los Angeles' work with inner-city schools, and the state of Alabama's unique Environment and Energy Education Consortium.

Anatomy

The viable environmental studies program today, whatever its taxonomy or etiology, usually seems to exhibit certain common characteristics. First, it is a budget line item, not a mendicant, although the level of funding may be less than ideal. The University of Vermont's new Environmental Program and New Jersey's veteran School of Conservation are representative of discrete administrative units. Second, the environmental studies program is usually a degree-granting program in its own right, not merely a "concentration" in somebody else's degree, although the credibility of some of the new environmental studies degrees may be suspect, and some piggy-back programs are thriving. Ball State's Natural Resources Program is typical of the degree status. Third, the instrumentality sponsoring the program offers a secure, or at least semi-secure, tenure track for junior faculty, although the heraldic trappings of the conventional disciplines may still be embryo in nature; for example, access to the more prestigious scholarly journals. Huxley College within Western Washington State represents the self-contained faculty. After a decade of mild cold war with established deans and dons, the environmental studies leader is again on easy speaking terms with his campus colleagues, as at Iowa State, where Craig Davis has a large "adjunct" faculty. The environmental studies leader is also establishing effective communications with his counterparts around the country, led, perhaps, by Michigan's William B. Stapp. Their collective penetration of the federal and foundation granting agencies is a mixed bag; Penn State's Center for the Study of Environmental Policy appears to have been particularly successful at tapping varied sources of support.

Morphology

What in fact do environmental studies programs look like today?

At the level of undergraduate education, one type is "Ecology U.", The University of Wisconsin-Green Bay, an entire institution custom-constructed around humankind-environment curricula, or Evergreen State in Washington, fabricated somewhat along the same lines. An intermediate model is St. Lawrence, where a discrete environmental studies unit has found a niche in an otherwise conventional liberal-arts college. A third approach is that of Colorado State's School of Forestry and Natural Resources, which has assimilated environmental studies without much structural change.

With respect to professional training, there are, on the one hand, those programs that represent adaptations of existing advanced degrees, such as the development in economics at Wyoming. On the other hand, there are multidisciplinary programs put together out of whole cloth, like the water resources management master's administered by the ambidextrous Institute for Environmental Studies at The University of Wisconsin-Madison.

At the level of environmental research and Ph.D. production, one model is the problem-oriented approach like UW-Milwaukee's Great Lakes Studies Center. Another model is the more discipline-based approach, such as Illinois' Department of Ecology, Ethology, and Evolution.

Extension, outreach, public service, continuing education—as you will—has likewise several models: Maryland's retooling of ag extension; broad biological and social science outreach, as effected by the University of Washington's Institute for Environmental Studies; professional school public service, as represented by the University of Illinois College of Law's Office of Environmental and Planning Studies; the University of Wisconsin System's "merged" approach.

Again, the striking feature is symmetry with diversity, or the other way around, depending on how you view the university animal.

Ecology

What of the interrelationships today among environmental studies programs and their colleges and universities?

Unquestionably, environmental studies have had a measurable impact on the campus. For undergraduates they have offered an air of relevance to the higher learning. For graduate and professional students, they have provided entres to new careers in both the public and private sectors. For faculty, environmental studies at their best have broken down the ivy curtains that had tended to shroud each discipline and its approach to researchable issues. For administrators, environmental studies have provided a nudge to rethink campus configurations and to explore new outreach activities.

In turn, the university environment has had a measurable impact on environmental studies. The innate conservatism of the campus has begun to mute the emotionalism of early environmental voices and substitute a more measured approach to public issues. New "hard" data from laboratory, library, and field are replacing yesterday's educated guesses. The growing austerity on the campus, on the other hand, now operates to depress the development of environmental studies teaching and research strengths, and reward-system constraints continue to make it problematic for some junior faculty members who might choose to do so to foresake their conventional disciplines for ES enterprise.

For better or worse, environmental studies and higher education will each never be the same again for their having entered into a marriage, 1968-1978.

THE ESSENCE OF CHANGE

In essence, environmental studies have brought to the campus the basic concept that the development of an optimum human environment requires an understanding and an application of the contributions which can be made individually and collectively by all the arts, sciences, social studies, and professions. Quite apart from the organizational adaptations developed to render operational this basic concept, the higher environmental studies seem to have evolved six pervasive themes or "red threads" running through all environmental instruction and research, whatever their particular site or strategy.

Unity

All components of any system are in varying degrees interconnected and interdependent. The integrity of the biosphere—and of humankind as a resident—is dependent upon the intricate balance of many subsystems. So with the global social system. Our concern must be for relationships, interactions, and the effects of various changes in conditions upon related subordinate, coordinate, and superordinate systems—biophysical and socioeconomic. Muir said it: "When we try to pick out anything by itself we find it hitched to everything else in the universe."

Fragility

No social system is immutable. All natural systems have a limited tolerance for perturbation. This concept pertains to the rate and extent at which physical and social degradation is introduced into the environment as well as to the rate and extent at which energy is dissipated, and natural and human resources are exploited or manipulated. Commoner said it: "There's no such thing as a free lunch."

Diversity

Long-term biological and sociological evolutionary processes invariably move toward increased complexity and higher levels of organization. It is by virtue of their diversity that mature natural and built ecosystems are adaptive enough to withstand a variety of traumas without loss of identity. But cultural intrusions of modern man have reduced both local and global ecological variety. The result—a threatened loss of stability to various ecosystems and ultimately to the total biosphere. Leopold said it: "To keep all the parts is the sign of intelligent tinkering."

Quality

Once seemingly efficient technologies and cultures have proven counterproductive in that they fail to function symbiotically with natural systems and human nature. If an environment capable of fulfilling humankind's higher-order aesthetic and humanistic needs is to be restored and maintained, certain value reorientations, some difficult tradeoffs, and some changes in lifestyle are in order. Lincoln said it: "We must disenthrall ourselves."

Policy

Resource conservation historically has involved largely private, technological, ad hoc, stop-gap solutions to limited problems. Environmental protection calls for a public decision-making process equipped for surveillance of the total environment and capable of imposing long-range economic, social, or legal sanctions against those elements presenting a threat to the public interest. Caldwell said it: "A positive public policy to protect the human environment is a practical necessity."

Responsibility

The interdisciplinary study of the people-resources-technology system is an important focus of any modern university. Bryson (1977) said it:

> "We must be concerned with such symptoms of the environmental malaise as preempted open space, endangered species, pollution, and declining quality of life, find the methods to treat these very real problems, and train people to treat them. We must also understand in depth the fundamental roots of these problems, and this means interdisciplinary studies of the people-environment system. This must be at the same time intensive, broad, and rigorous, transcending the traditional disciplines. Since this is a departure from the well-tried, highly successful, and necessary training of specialists within the disciplines in the universities, it requires new patterns of teaching and research. For a university to turn a portion of its intellectual might towards the critical problems of our environmental system, it needs the understanding,

> support, and participation of both scholars and citizens. It will need new arrangements of scholars and technicians, and new institutional structures within the universities. However, it is not sufficient to put people from a variety of disciplines in a paper organization and call it interdisciplinary studies. They must learn, as individuals, to think in holistic terms, for creativity is individual and the problems of the world ecosystem transcend the disciplines."

THE FUTURE OF CHANGE

What of tomorrow?

There may be vociferous arguments over timing and degree, but there is little argument today that our world of tomorrow will demand, on the one hand, a less destructive technology and on the other a less consumptive lifestyle. (That there is such little argument over kind can be attributed, by the way, to effective environmental education at all levels.) Given competent, dedicated personnel and adequate funding, environmental studies programs in colleges and universities can certainly contribute to the discovery and application of more benign technology. Whether they can contribute to a more conservative American lifestyle is a real question.

It is not that environmental studies people do not talk a good conservation ethic; they do. It is simply that the typical university environment is the antithesis of the resource-saving that may be called for. Highrise air-conditioned residence halls with windows that can't be opened, acres of blacktopped parking lots in the absence of mass transit, no light and heat discipline in classrooms or labs, students celebrating TGIF as if there were no tomorrow, professors jetting themselves around the globe to manifold learned meetings, echelons of vice chancellors still preaching the gospel of growth, alumni demanding it—at least on autumn Saturday afternoons: all this is hardly conducive to the inculcation of a more frugal standard of living.

Perhaps what we need is an experimental second-generation environmental studies program, a prototype of the spartan campus that tomorrow may require (Haubrich 1978). The model is easy to delineate:

A dormitory open to the winds in summer, in winter heated by individual potbellied stoves in each room, the fuel harvested from campus woodlots. No private vehicles. Lights out at taps. The weekend feature the Thespian Society play. Faculty confined to train rides. Vice chancellors absent. Alumni leading prayer meetings instead of pep rallies.

Weird? That is an accurate paraphrase of John Muir's account of his freshman year at The University of Wisconsin in the 1860's. One would be hard-pressed to say his austere environment depressed young Muir's lilting spirit. Far from rendering him a knight in search of affluence, it made him the first major custodian of our natural wonders. It would at least be interesting to see what a John Muir Experimental College of Environmental Ethics might accomplish in the 1980's.

Yet it is unrealistic, of course, to contemplate a precipitous mass retreat to the leanness of the mid-19th century campus. Such a retreat could not be effectuated short of a political dictatorship that would be at least as evil as the disease of environmental degradation. Given the growing insights of environmental scientists and engineers, such a retreat should not be necessary. But those same scientists and engineers will be hard-pressed to achieve a sanative development of available world resources in the absence of a change of pace in resource husbandry and consumption.

Until now we have done only what was easy, or what government could do, or both. We have not really confronted the profound changes in interdisciplinary science and individual lifestyle the environmental imperative may demand. The greatest successes of the federal Environmental Protection Agency so far, for example, have come from applying existing technology to specific sources of emissions and effluents; still to be introduced—and far more difficult—are pollution control measures that involve real changes in American lifestyles and land-use patterns (Train 1977). It could be we will be saved only by profound research applied to environmental needs, coupled with a hippy-type culture with a haircut, as it were, a culture composed of fewer addictive consumers and compulsive wasters, yet one retaining the luxury of indoor plumbing (Arnsdorf 1975). We must believe it inconceivable that a country which has passed from Depression and global war to putting men on the moon cannot somehow discover the technological and philosophical insights that will preserve the human animal in some state of reasonable harmony with his fellow passengers, great and small, on their mutual spaceship. A reasoned optimism is a requirement for progress. To take undue counsel of our fears is to court defeat.

Unquestionably we need continued and continual reshaping of education at all levels if humankind is to survive in the sort of world that is fast evolving (Reischauer 1973), what Ashby (1974) calls "education for insecurity" in a global society "wired together so tightly that a short-circuit can fry us all."

Good (1977) has outlined key curricular content admirably:

World population is doubling approximately every 40 years. Humankind has consumed more of the world's energy resources in the three decades since World War II than in all previous history. The essential elements of food production—land, water, energy, fertilizer—are becoming scarcer and more expensive. We are straining the capacity of the environment to handle various pollutants. The problems are interconnected. For example, increasing the food supply means increased use of energy and increased non-point pollution. One solution, in short, can become part of the problem.

Tackling such worldwide, interconnected environmental problems obviously can be the responsibility of no particular university department. The whole of higher education has a stake in teaching, research, and outreach concerned with major trends in population growth, natural resource utilization and management, alternative energy sources, opportunities for and constraints on expanding the world's food supply, the broad issues affecting the harvesting of oceans and the mining of seabeds, the dynamics of economic growth as they relate to problems of transnational pollution, the dangers of nuclear proliferation, the radical disparities between the developed and the undeveloped parts of the world, threatened wildlife and natural amenities, the dilemma of the city, and on.

The continued success of the environmental effort in the United States will depend on three things, says Train (1977): our ability and willingness to find ways of keeping costs, inequities, and inefficiencies to a minimum and of encouraging constructive reconciliation of environmental, social, and economic goals; second, the effective redirection of the environmental effort to ensure a steady shift from the control of pollutions to their prevention; and third, the strength of the general public's commitment to environmental protection—which leads us back to environmental education and its effectiveness or non-effectiveness.

Several skills are needed by professors and students in environmental studies, Good (1977) says:

1. Skill in the analysis of complex interactive systems, long-term effects, linkages of factors, and the worldwide consequences of local decisions and actions.

2. Skill in the historical analysis of the human perceptions, attitudes, and ideologies that can complicate the application of scientific knowledge to the solution of environmental problems in differing economic and political systems and in differing cultures.

3. Skill in the analysis of values and in rendering moral judgments; in recognizing, for example, that growth and progress are not necessarily synonymous.

4. Skill in personal involvement in problem- and policy-oriented interdisciplinary action befitting a literate citizen of a beleaguered planet.

The selected case studies in this book suggest a variety of ways and means by which university teaching, research, and outreach can help meet a national need for environmental data, doctrines, and action.

Cooley (1977) believes "an interesting follow-up to these case studies would be to make an assessment of the students who have been or are involved in these diverse programs around the country: What are their goals and objectives? Are they getting what they want and need? How are they doing in the job market?" Such a study would assuredly merit federal or foundation support.

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